APPENDIX A

SAMPLING AND ANALYSIS PLAN

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FORMER GEORGIA-PACIFIC CALIFORNIA WOOD PRODUCTS MANUFACTURING FACILITY
90 WEST REDWOOD AVENUE
FORT BRAGG, CALIFORNIA
AME PROJECT NO. 16017.07

June 8, 2005

Prepared By

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This Sampling and Analysis Plan (SAP) describes procedures to be followed by Acton • Mickelson • Environmental, Inc. (AME), during collection of subsurface soil, sediment, concrete, surface water, and ground water samples, as well as the analytical methodology to be used by the analytical laboratory. It provides established guidelines that ensure samples represent actual field conditions and are labeled, preserved, and transported properly to retain sample integrity. Sampling will be conducted in general accordance with procedures outlined in guidance documents from the American Society of Testing and Materials (ASTM), United States Environmental Protection Agency (EPA), and California Environmental Protection Agency (Cal-EPA).

1.0 SUBSURFACE EXPLORATION SOIL SAMPLING PROCEDURES

Soil borings and sampling will be performed under the direction of an appropriately registered AME professional. Soil borings will be advanced using:

- Truck-mounted, hollow-stem auger drill rig
- Truck-mounted, track-mounted, or barge-mounted direct push rig
- Hand auger

Investigation of fill areas will be accomplished through backhoe excavation or use of large-diameter auger equipment.

1.1 Soil Sample Collection from Hollow-Stem Auger Borings

Soil samples will be collected at 5-foot vertical intervals and in general accordance with ASTM D1586-84 (reapproved 1992), modified to allow the use of a 2-inch-diameter split-barrel sampler. Using this procedure, three 2-inch-diameter, 6-inch-length, stainless-steel tubes are placed in a California-type split-barrel sampler, which is driven into the soil by a 140-pound weight falling 30 inches. After driving the sampler an initial distance of 6 inches (seating drive), the number of blows required to drive the sampler an additional 12 inches is known as standard penetration resistance, or the "N" value. The "N" value is used as an empirical measure of the relative density of cohesionless soil and the consistency of cohesive soil. Upon recovery of the split-barrel sampler, the stainless-steel tubes containing the soil will be removed.

Soil samples intended for volatile organic compound (VOC) testing will be obtained in accordance with U.S. EPA Method 5035. Soil samples will be obtained with a discrete soil-sampling device (EnCore™ sampler or SoilCore™ sampler or equivalent). The soil samples need to be received by the laboratory or frozen within 48 hours of sampling.

The soil samples for VOC testing will be taken from the bottom of the three stainless-steel tubes. The tube will then be sealed at the ends with Teflon® tape and plastic end-caps. The percent recovery of the sample will be recorded. The sample will be labeled with an identification number, time, date, location, and requested laboratory analysis, then placed in a plastic bag and stored at approximately 4 degrees Celsius (°C) in an ice chest for transport to the laboratory. Sample custody procedures outlined in Section 7.0 will be followed for each sample collection.

Soil in the second stainless-steel tube will be extracted upon recovery, placed in a plastic bag, sealed, and placed out of direct sunlight for later screening for organic vapors using a photoionization detector (PID) or flame ionization detector (FID).

Soil will be examined for composition, color, and moisture content, and a complete log of soil conditions will be recorded on a soil boring log (Appendix A-1) using the Unified Soil Classification System (USCS, Appendix A-2).

The split-barrel sampler will be cleaned to prevent cross-contamination for each sampling interval using procedures described in Section 4.0. Soil borings advanced with hollow-stem augers will generate drill cuttings. The soil generated from the soil borings will be stored in 55-gallon drums and labeled with the corresponding boring number, date, and address of the facility. Alternatively, the soil generated from the soil borings may be placed on and covered with plastic and stored onsite until characterized for disposal. After drilling, borings not intended for monitoring well construction will be backfilled with neat cement.

1.2 Sample Collection from Direct Push Borings

A continuous core will be collected by pushing a Macrocore sampler containing a 4-foot long acrylic or polyvinyl chloride (PVC) tube. Soil samples selected for laboratory analysis will be obtained by saw cutting a 6-inch length from the soil-filled acrylic tube and sealing the ends of the removed segment with Teflon® tape and plastic end-caps.

Soil samples intended for VOC testing will be obtained from the tube in accordance with EPA Method 5035 (see Section 1.1). Soil from a portion of the tube will be extracted, placed in a plastic bag, sealed, and placed out of direct sunlight for later screening for organic vapors using a PID or FID. The soil will be examined for composition, color, and moisture content, and a log of soil conditions recorded on a soil boring log (Appendix A-1) using the USCS (Appendix A-2).

The sample will be labeled with an identification number, time, date, location, and requested laboratory analysis, then placed in a plastic bag and stored at approximately 4°C in an ice chest for transport to the laboratory. Sample custody procedures outlined in Section 7.0 will be followed.

1.3 Fill Area Excavations

Investigation of fill areas will be accomplished using either large-diameter auger equipment or by backhoe excavation. Use of a large-diameter auger is preferred over standard 4-inch diameter solid-stem or 8-inch diameter hollow-stem auger equipment because the larger diameter augers typically provide a more representative sample of heterogeneous fill materials. Advantages of backhoe use are that setup time is reduced and a larger area can be explored by excavating a wider or longer trench. One disadvantage of the backhoe is the limited vertical reach of the bucket usually restricted to approximately 15 feet for a tire-mounted unit.

Soil samples will be collected from the large-diameter borings or excavations directly from the auger flights or the backhoe bucket. Samples will be handled as described in Section 1.1. Equipment will be decontaminated as described in Section 4.0. Large-diameter borings and test excavations will be backfilled with soil cuttings from the respective excavations.

1.4 Sample Collection from Remedial Excavations

Soil samples will be collected from Interim Remedial Measure (IRM) excavations to evaluate residual chemical-compound concentrations. The samples will be collected directly from the excavator bucket to prevent physical hazards from personnel entering the excavations. Soil removed from the IRM excavation bottom or sidewalls will be placed in a stainless-steel tube in such a way that no headspace exists. The ends of the tube will be covered with Teflon sheets followed by plastic end caps. The samples will be labeled with an identification number, time, date, location, and requested laboratory analysis, then placed in individual plastic bags and stored at approximately 4°C in an ice chest for transport to the laboratory.

Soil generated during IRM excavations will be either loaded directly into trucks for transport to a disposal facility or placed on and covered with plastic sheeting pending disposal characterization.

1.5 Concrete Sample Collection

Concrete samples will be collected from building foundations during their excavation and removal. The foundations will be broken into small portions and stockpiled onsite pending waste disposal characterization. Samples of the concrete will be collected for laboratory analysis from the stockpiles. Fragments of the concrete will be collected and double-bagged in sealed plastic bags to prevent any spillage of material during transport.

Laboratory test samples will be sent to a materials testing (geotechnical) laboratory and crushed in preparation for chemical analysis. In accordance with analytical laboratory recommendations, the crushed samples will be stored at approximately 4°C in an ice chest during laboratory shipment. Each sample will be labeled with an identification number, time, date, location, and requested laboratory analysis. Sample chain-of-custody documentation will be maintained from collection to laboratory delivery.

Following disposal characterization, non-hazardous concrete waste will be crushed and used onsite or loaded (uncrushed) onto trucks for transport to Norcal Rock in Willits, California, an offsite recycling/disposal facility. Concrete containing chemical concentrations deemed hazardous will be transported to a Class I landfill for disposal.

1.6 Ground Monitoring Well Construction

The ground water monitoring wells will be installed using 8-inch diameter hollow-stem augers. The boring will be drilled 6 feet past first encountered ground water. After the boring has reached total depth, 2-inch diameter schedule 40 PVC casing will be installed. Ten feet of screen will be installed within the well, and 6 feet of screen will extend below first encountered ground water. The well screen slot size will be 0.020 inch. Before installation of the screen with attached end cap, a 6-inch layer of Number 2/12 sand pack or equivalent will be added to the boring to act as a cushion for the casing.

After the casing is placed within the boring, the sand pack will be added to approximately 2 feet above the uppermost casing slot. One foot of bentonite will be added to the top of the sand pack and hydrated with clean water. The remainder of the boring annulus will be filled with neat Portland cement. At the ground surface, the well will be protected with a flush mounted traffic rated Christie box or locking riser as appropriate. If placed within a Christie box, the top of the well casing will have a locking cap.

1.7 Sediment Sampling

1.7.1 Pond Areas

The RWQCB – North Coast Region requested that the full depth of sediments and fill beneath the ponds be assessed. The borings will be performed at approximately equally spaced intervals along the axes of the ponds.

The various ponds contain several inches to several feet of water. The condition of the ponds will be assessed to determine whether foot or boat access is required for sediment sample collection. If conditions allow, a hand corer sampler with liner tubes will be used to collect sediment samples. This sampler can be used while standing in a dry or shallow pond or while floating in a boat in a deeper pond. If possible, continuous core will be collected from the top of the sediments to native material, bedrock, or refusal. Samples will be retained for testing and handled in general accordance with Section 1.2.

Sample locations will be recorded using global positioning system (GPS) equipment. Depth of overlying water, if any, will be measured with a graduated, weighted tape. Depth of sediment will be initially measured using graduated metal or PVC probes pushed by hand.

1.7.2 Storm Drain

Sediment samples can be obtained by pressing a clean stainless steel sampling tube directly into the media to be sampled. If necessary, a slide hammer can be used to imbed the sample tube. Samples will be retained for laboratory testing in accordance with Section 1.2.

1.8 Geophysical Surveying

Site geophysical surveys will be conducted using several methods to identify anomalies that may represent buried objects and debris, fill areas, and areas of higher soil electrical conductivity (possibly indicative of impact from chemicals of potential concern). Land-survey area and geophysical-survey grid boundaries will be established, and land will be surveyed to sub-meter accuracy using GPS equipment, as well as referencing the state plane coordinate system and 1983 North American Datum. All geophysical survey data will be digitally field-recorded, and survey results will be interpolated into a regular grid and reported in a geo-referenced digital format.

The geophysical surveys will utilize ground conductivity and time domain electromagnetic metal (TDEM) detector surveys. The ground conductivity survey will use the Geonics EM-31 terrain conductivity meter, which uses electromagnetic induction to measure ground conductivity. The Geonics EM-61 will be used for the TDEM survey to detect buried metallic objects. Both instruments will be operated in automatic data acquisition mode and will field-record data in a data logger. Data will be recorded along grid lines at approximately 10-foot spacing to cover the areas of concern. Survey data locations will be obtained simultaneously using a hand-held GPS unit.

2.0 MEASUREMENTS OF WATER LEVEL AND APPARENT THICKNESS OF PHASE-SEPARATED HYDROCARBONS, ALSO KNOWN AS LIQUID-PHASE HYDROCARBONS

Phase-separated hydrocarbons (PSH) have been reported in Parcel 5 monitoring well MW-5.1. Measurements of water levels and apparent thickness of PSH will be conducted in general accordance with ASTM D4750 (reapproved 1993). The static water level and apparent PSH thickness in each well will be measured with an electronic interface probe prior to purging or sampling.

The interface probe includes a wire that is marked at 0.01-foot intervals and will be lowered slowly into the well until PSH or water is encountered (the interface probe emits one of two tones depending on whether it encounters PSH or water). When either PSH or water is encountered, depth will be recorded by checking the 0.01-foot-interval markings on the interface probe wire against a predetermined reference point on the well casing (permanent reference points, surveyed to a common reference point, will be marked on the well casings, and all well casing riser elevations will be known to within 0.01 foot).

If the first substance encountered is PSH, the probe will continue to be lowered after depth-recordation until the tone corresponding to water is emitted, at which point depth will again be recorded as described above. The difference between the first and second recorded depths is apparent PSH thickness. The interface probe will be rinsed with a cleaning solution and deionized water between measurements in different wells.

Sampling of PSH for analysis will not be performed. Further, no attempt will be made to sample or analyze ground water from monitoring wells where the presence of a measurable PSH layer is indicated by interface probe readings.

For sites where PSH is not present, static water level will be measured using either a conductance probe level meter or an electronic interface probe. Like the interface probe, the conductance probe level meter emits a steady tone upon encountering any conductive fluid (e.g., water) and includes a wire marked at 0.01-foot intervals. The procedure for obtaining static water levels with the conductance probe level meter is basically the same (when PSH is not encountered) as for an interface probe.

3.0 GROUND WATER SAMPLING

Ground water sampling will be conducted in general accordance with ASTM D4448 (reapproved 2001). When ground water monitoring wells are accessed, the wellhead atmosphere will be monitored by FID or a lower explosive limit (LEL) meter. If monitoring indicates greater than 5,000 parts per million by volume (ppmv) with the FID or greater than 10 percent with the LEL meter, dry ice will be placed in the wellhead to displace the potentially explosive vapors, and sampling will not proceed until concentrations are reduced below the action levels.

3.1 Well Evacuation

If traditional well purging methods are used, prior to collection of a ground water sample, stagnant water will be removed from the well casing and surrounding gravel pack by bailing, pumping, or using a vacuum truck. At least three casing volumes of water will be removed from each well to be sampled (unless low-flow purging is performed for measurement of dissolved oxygen, as described in Section 3.2). The volume of water in the casing will be determined using the known elevation of the water surface, the well-bottom elevation (as measured at well installation), and the well diameter.

If the well is bailed or pumped during purging, samples will be collected and field analyzed for pH, temperature, turbidity, and specific conductance. The well will be considered stabilized when repeated readings of the following parameters are within the ranges indicated as follows:

- Specific conductance ±10 percent of the reading range
- pH ±0.1 pH unit
- Temperature ±0.5° C
- Turbidity less than 5 nephelometric turbidity units

After stabilization, and after at least three casing volumes are evacuated, a sample will be collected for analysis. The field container used for well-stabilization measurements, and the pH, temperature, and conductivity probes will be rinsed between wells with deionized water.

All purge water will be containerized and documented for disposal as described in Section 6.0. If the containers are stored onsite, a label specifying the date of purging, source, and the known or suspected nature of the contents will be affixed to each container.

3.2 Low-Flow Well Evacuation and Sampling

In general, ground water sampling will be accomplished using the low-flow purging method in general accordance with ASTM D6771 (2002). Dedicated polyethylene sample tubing will be used at each location, and samples will be obtained with a peristaltic pump. The pump intake (i.e. the end of the drop tubing) shall be set mid-way between the water table and the bottom of the screen for shallow wells. The initial purging rate will not exceed 0.1 gallons per minute (gpm) or 0.5 liters per minute (lpm). The depth to water in the well will be measured and recorded on the field form along with other field parameters. The flow rate will be adjusted to minimize drawdown, with a 0.33 feet maximum drawdown as is target. The ground water purge flow is directed into a flow-through cell for measurement of field parameters. Measurements of field parameters will be obtained at the following minimum intervals (assumes flow-through cell net volume of approximately 0.25 gal):

Purge Rate (gpm)	Purge Rate (lpm)	Measurement Interval (minutes)
0.06	0.25	4
0.12	0.5	2
0.25	1	1

Purging will continue until three consecutive readings fall within the ranges specified below:

Parameter	Criterion
pH	+/- 0.1 pH unit
Specific Conductance	+/- 10 percent
Turbidity	Minimize. Greater of +/- 10 percent or +/- 1 NTU
Dissolved Oxygen	+/- 0.1 mg/L
Temperature	+/- 0.5 degrees C.

To obtain samples, the pumping rate will be first reduced to 0.06 gpm or 0.25 lpm. Samples will then be collected ahead of flow through cell by filling the containers directly from the dedicated tubing. Samples will be collected in the following order: 1) volatiles, 2) amber glass, 3) other, and 4) field filtration to polyethylene containers for metals.

3.3 In-Situ Measurement of Dissolved Oxygen

Measurement of dissolved oxygen in ground water may be performed in-situ with a dedicated field instrument. The instrument probe is lowered for placement within the screened interval of the

monitoring well, and typically remains undisturbed throughout a test. Measurements are performed according to instrument-specific instructions.

3.4 Grab Ground Water Sampling

Grab ground water samples may be obtained with an exposed-screen sampling apparatus in general accordance with ASTM D6001 (reapproved 2002). At the target interval, an exposed-screen sampler will be opened to the formation from which a grab ground water sample will be collected with a peristaltic pump. The sample is then transferred to the laboratory-supplied containers. Dedicated polyethylene sample tubing will be used at each location.

3.5 Surface Water Sampling

3.5.1 Pond Areas

A short bailer will be used to collect surface water samples. The water samples should be taken from an area where bottom sediments have not been disturbed. The samples will be handled as described in Section 3.6.

3.5.2 Storm Drain

If there is adequate water volume, water samples will be obtained from the storm drain by immersing sampling containers directly into the water using caution to avoid disturbing bottom sediments. If there is inadequate water depth to immerse the containers, then water will be transferred into them from a clean sampling cup. The samples will be handled in accordance with Section 3.6.

3.6 Sample Collection, Preservation, and Handling

A new polyethylene disposable bailer will be used to collect ground water samples after standard well evacuation or for grab sampling. The bailer is attached to a new disposable rope and lowered slowly into the water to avoid agitation of the collected sample. In low-flow evacuation, samples are collected from a sampling port in the inlet line to the flow-through chamber with the well evacuation pump operating. Containers for VOC analysis will be filled so that no air space remains in the vial after sealing.

All sample containers will be prewashed and prepared in accordance with laboratory quality assurance/quality control protocols. Only sample containers appropriate for the intended analyses will be used.

After being collected, samples will be sealed in zip press bags, placed into coolers with ice packs that maintain a temperature of approximately 4ºC, and therein transported to the analytical laboratory.

4.0 DECONTAMINATION PROCEDURES

All equipment that comes into contact with potentially contaminated soil, drilling fluid, air, or water will be decontaminated before each use in general accordance with ASTM D5088. Decontamination will consist of steam-cleaning, a high-pressure, hot-water rinse, or trisodium phosphate (TSP) or Alconox®/Liquinox® wash and fresh water rinse, as appropriate.

Drilling and sampling equipment will be decontaminated as follows:

1. Drill rig augers, drill rods, drill bits, and backhoe buckets will be steam-cleaned prior to use and between borings or excavations. Visible soil, grease, and other impurities will be removed.

2. Soil sampling equipment will be steam-cleaned prior to use and between each boring. Prior to individual sample collection, any sampling device will also be cleaned in a TSP or Alconox®/Liquinox® solution and rinsed twice in clean water. Any visible soil residue will be removed.

3. It is anticipated that disposable equipment will be used to collect water samples. If disposable equipment is not used, water sampling equipment will be decontaminated using methods described in Item 2 for soil sampling equipment.

4. Water sampling containers will be prepared in accordance with the respective analytical laboratory's quality assurance/quality control procedures.

5. Soil sampling tubes will be steam-cleaned or washed in TSP or Alconox®/Liquinox® solution and rinsed with clean water.

6. Field monitoring equipment (pH, conductivity, or temperature probes) will be rinsed with clean water prior to use and between samples.

5.0 FIELD MEASUREMENTS

Field data will be collected during various sampling and monitoring activities; this section describes routine procedures to be followed by personnel performing field measurements so that field measurements are consistent and reproducible when performed by various individuals.

5.1 Buried Utility Locations

All work associated with soil borings will follow the pre-drilling protocol specified in the Site Health and Safety Plan (Appendix B).

5.2 Lithologic Logging

A log of soil conditions encountered during drilling and sample collection (Appendix A-1) will be maintained using the USCS (Appendix A-2) by an AME geologist. All boring logs will be reviewed by a California registered geologist. The collected soil samples will be examined, and the following information will be recorded:

- Boring location
- Sample interval and depth
- Blow counts
- Color
- Soil type
- Moisture content (qualitative)
- Depth at which ground water (if present) is first encountered
- Field screening results obtained using a portable PID or FID

5.3 Conductivity, Temperature, pH, Turbidity, and Dissolved Oxygen

Specific conductance, temperature, pH, turbidity, and dissolved oxygen measurements will be made when a water sample is collected. For standard well evacuation, a representative water sample will be placed in a transfer container used solely for field-parameter determinations. For low-flow evacuation, measuring instruments will be placed in the flow-through sampling cell.

Combination instruments capable of measuring any or all of the parameters may be used. All instruments will be calibrated in accordance with manufacturer methods, and:

- Conductance: Values for conductivity standards used in calibration will be recorded daily in a field notebook

- Temperature: May be checked using standard thermometers

- pH: Values for pH buffers used in calibration will be recorded daily in a field notebook

- Turbidity: Values for turbidity standards used in calibration will be recorded daily in a field notebook

- Dissolved oxygen: Meter will be zeroed with a solution of 50 grams sodium sulfite in one liter of distilled water

All probes will be cleaned and rinsed with fresh water prior to any measurements, in accordance with Section 4.0.

5.4 In-Situ Dissolved Oxygen Meter

A dissolved oxygen meter with a probe designed for stagnant-water measurement will be used. The meter will be calibrated twice per day in accordance with manufacturer instructions: once before the first use and once after the last use.

5.5 PID, FID, and LEL Meter Calibration

Field personnel will calibrate the PID, FID, and LEL meters for vapor measurements at least twice per day: once each before the first and last use. The PID, FID and LEL meters are zeroed on ambient air. In addition:

- FID and LEL: Meters will be calibrated to a methane-in-air standard obtained from a calibration gas cylinder
  - The primary FID meter calibration point will be 200 ppmv methane (low range)
    - The FID may be alternately calibrated (on the high range setting) to 5,000 ppmv methane, using 10 percent LEL (0.5 percent by volume) calibration gas
  - The primary LEL meter calibration point will be 50 percent of LEL (2.5 percent by volume or 25,000 ppmv methane)
- The PID meter will be calibrated to an isobutylene-in-air standard of 100 ppmv obtained from a calibration cylinder

6.0 DISPOSAL PROCEDURES

During the above operations, soil and fluids produced or used during the installation and sampling of borings and wells known or suspected to contain potentially hazardous materials will be retained onsite in appropriate containers (i.e., drums, bins, tanks) until chemical testing has been completed to determine the proper means of offsite disposal. Handling and disposal of substances known or suspected to contain potentially hazardous materials will comply with the applicable regulations of the Cal-EPA, the California Department of Water Resources, and any other applicable regulations.

Waste ground water will be containerized onsite (initially being pumped into drums or temporary holding tanks) pending chemical testing for disposal characterization, after which it will be handled for disposal as described above.

Residual substances generated during cleaning procedures that are known or suspected to contain potentially hazardous materials will be placed in appropriate containers until chemical testing has been completed to determine the appropriate means for offsite disposal.

Non-hazardous soil will be transported to either Waste Management, Inc., Redwood Landfill in Novato, California, or Potrero Hills Landfill in Suisun City, California. Hazardous soil will be transported to Waste Management, Inc., Kettleman Hills Landfill in Kettleman City, California.

Both non-hazardous and hazardous liquids will be transported to Evergreen Environmental Services in Newark, California for recycling.

7.0 SAMPLE CUSTODY

This section describes standard operating procedures for sample custody (i.e., field custody [Section 7.1] and laboratory custody [Section 7.2]) and chain-of-custody documentation. Sample-custody procedures will be followed through sample collection, transfer, analysis, and disposal, so that:

- Sample integrity is maintained throughout collection, transportation, and pre-analysis storage
- Post-analysis sample-material disposal is appropriate

7.1 Field-Custody Procedures

Sample quantities, types, and locations will be determined before actual fieldwork commences. The field sampler is personally responsible for sample care and custody from collection until transfer. The number of people handling samples should be minimized.

7.1.1 Field Documentation

Each sample will be labeled and sealed immediately after collection. Sample-identification documents will be prepared so identification and chain-of-custody records can be maintained and sample disposition controlled. Forms will be completed with waterproof ink. Sample-identification documents include:

- Sample labels
- Field notebook
- Chain-of-custody forms

7.1.2 Sample Labels

Preprinted sample labels will be used to provide sample identification. Clean label-protection tape will be used to protect labels from water and solvents, where necessary. Each label includes:

- Name of collector
- Date and time of collection
- Place of collection
- AME project number
- Sample number
- Preservative (if any)

7.1.3 Field Notebook

Field-survey, measurement, and/or sampling information will be recorded in a bound notebook or on the daily field log. Notebook entries should include:

- Name and title of author
- Date and time of entry
- Physical/environmental conditions during field activity
- Location of sampling or measurement activity
- Name(s) and title(s) of field crew
- Type of sampled or measured media (e.g., soil, ground water, concrete)
- Sample collection or measurement method(s)
- Number and volume of sample(s) taken
- Sample containers and container batch numbers
- Description of sampling point(s)
- Description of measuring reference points
- Date and time of measurement collection
- Sample identification number(s)
- Sample preservative (if any)
- Sample distribution (e.g., laboratory)
- Field observations/comments
- Field measurements data (e.g., pH)

7.1.4 Chain-of-Custody Record

A chain-of-custody record will be completed and accompany every sample and sample shipment to analytical laboratories in order to establish necessary documentation to trace sample possession from the time of collection. Each chain-of-custody record will include:

- Sample or station number or sample I.D.
- Signature of collector, sampler, or recorder
- Date and time of collection
- Place of collection
- Sample type
- Signatures of persons involved in the chain of possession
- Inclusive dates of possession

The laboratory portion of the form should be completed by laboratory personnel and will include:

- Name of person receiving the sample
- Laboratory sample number
- Date and time of sample receipt
- Analyses requested
- Sample condition and temperature

7.1.5 Sample Transfer and Shipment

Samples will always be accompanied by a chain-of-custody record, including during shipment. When transferring samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the chain-of-custody record. Samples will be packaged for shipment and dispatched to the identified laboratory for analysis, and the method of shipment, courier name(s), and other pertinent information will be entered into the chain-of-custody record.

7.2 Laboratory-Custody Procedures

Upon sample arrival at the laboratory, a designated sample custodian will accept custody of the shipped samples, compare sample labels with the chain-of-custody record to verify consistency, and review method-of-delivery and sample-condition information on the chain-of-custody record. The custodian will then enter the appropriate data into the laboratory sample-tracking system using the sample number on the sample label or assigning a unique laboratory number to each sample, and transfer the sample(s) to the proper analyst(s) or store them in the appropriate secure area. In the event of sample leakage or other evidence of sample damage, the laboratory will contact the project quality assurance officer for a decision regarding sample disposition.

Laboratory personnel are responsible for sample care and custody from sample receipt until sample exhaustion or disposal and, for the intended analyses, handle samples in accordance with *EPA SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Third Edition*. All data sheets, chromatographs, and laboratory records will be filed as part of the permanent documentation.

7.3 Corrections to Documentation

Original data recorded in field notebooks, chain-of-custody records, and other forms should be written in ink. These documents should not be altered, destroyed, or discarded, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made or found on a document, the individual will make a correction by crossing a single line through the error, entering the correct information, and initialing and dating the change. The erroneous information will be obliterated. Any subsequent error(s) discovered on a document will also be corrected, initialed, and dated.

7.4 Sample Storage and Disposal

Samples and extracts should be retained by the analytical laboratory for 30 days after receipt. Unless notified by the program manager, excess or unused samples should be disposed by the laboratory in an appropriate manner consistent with applicable government regulations.

8.0 WELL DESTRUCTION

Prior to well destruction all necessary permits will be obtained from the Mendocino County Department of Public Health Division of Environmental Health (MCEH) by the well driller. Wells will be destroyed in accordance with applicable sections of the Department of Water Resources (DWR) Bulletins 74-81 and 74-90. The well driller will provide at least 24 hours notice to MCEH prior to performing the well destruction. The wells will be destroyed by overdrilling the annulus to the total depth of the well with hollow-stem auger drilling equipment. The width of the annulus will be exceeded by at least 1 inch. Cuttings and well construction materials will be stored onsite in labeled 55-gallon drums and disposed in accordance with jurisdictional requirements. After overdrilling the well, tremie pipe will be inserted to the bottom of the boring. As the augers are removed, neat Portland cement will be added to fill the boring through the tremie pipe. After the augers are removed and the cement has settled, the borings will be topped off to the ground surface with neat cement. After well destruction, a Well Completion Report will be filled out and a copy sent to the DWR.

9.0 SAMPLE ANALYSES

Implementation of the Work Plan at the site will result in the collection of concrete, soil, sediment, and ground water samples, which will be analyzed according to methods discussed in the following sections. Analytical method reporting limits and holding times are described in the Quality Assurance Plan (Appendix C).

9.1 Soil, Sediment, and Concrete Samples

Soil and sediment samples may be collected in stainless-steel, acrylic, or PVC tubes during soil boring activities (Section 1.0). Soil, sediment, and concrete samples will be analyzed by one or more of the following test methods:

- Total petroleum hydrocarbons as gasoline (EPA Method 8015 Modified)
- Total petroleum hydrocarbons as diesel and motor oil with silica gel cleanup (EPA Method 8015 Modified)
- VOCs (EPA Method 8260)
- VOCs (EPA Method 8260 with sample collection by EPA Method 5035)
- Semi-VOCs (SVOCs) (EPA Method 8270)

- Polynuclear aromatic hydrocarbons (EPA Method 8270 or 8310)
- Polychlorinated biphenyls (EPA Method 8082)
- Dioxins and furans (EPA Method 8290)
- Site-specific pesticides/herbicides (various EPA and in-house methods)
- California Title 22 Metals (EPA 6010/7400)
- Hexavalent chromium (EPA Method 7196)
- Cyanide (EPA Method 9010B or 335.4)
- Didecyldimethylammonium chloride (North Coast Laboratories in-house method)
- Nitrate, as nitrogen (EPA Method 300.0)
- Nitroglycerine (EPA Method 8332)
- Phenol, tetrachlorophenol, and pentachlorophenol (EPA Method 8270)
- Pentachlorophenol (water only, EPA Method 515.1)
- Nitrilotriacetic acid (special method)

In addition to the chemical analyses, selected soil samples may by analyzed for physical parameters by the following ASTM methods or equivalent:

- Dry bulk density (ASTM D2937)
- Moisture content (ASTM D2937)
- Total porosity (ASTM D854 and D2937)
- Total organic carbon (ASTM D2974)

9.2 Surface and Ground Water Samples

Surface and ground water samples will be collected from ponds, storm-drains, monitoring wells, and soil borings and analyzed by one or more of the test methods listed in Section 9.1.

10.0 REMARKS

This plan represents our professional opinions, which are based on client-supplied and currently available information and have been arrived at in accordance with currently accepted hydrogeologic and engineering practices at this time and location. Other than this, no warranty is implied or intended. Any reliance on the information contained herein by third parties is at such parties' sole risk.

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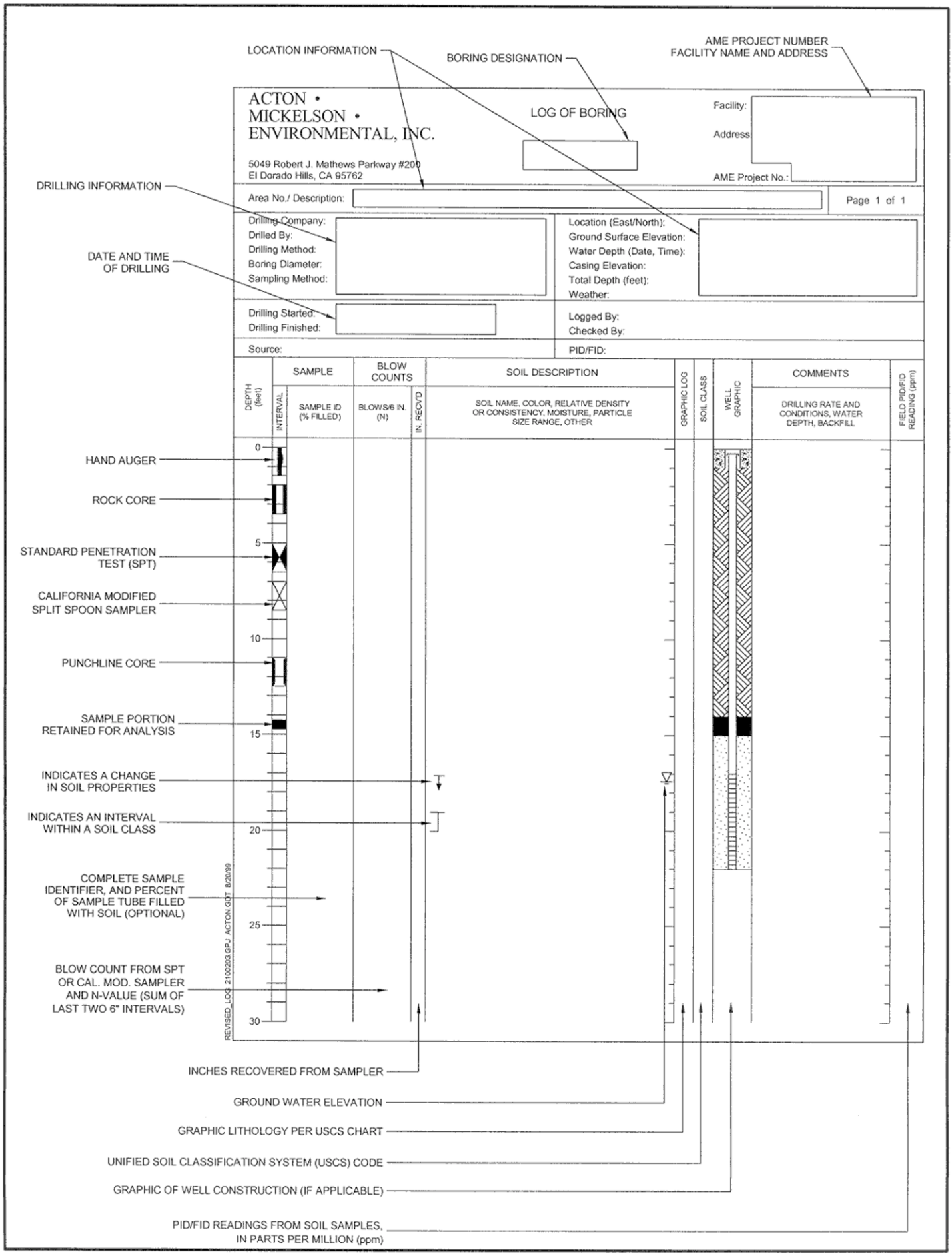
This plan represents our professional opinions, which are based on client-supplied and currently available information and have been arrived at in accordance with currently accepted hydrogeologic and engineering practices at this time and location. Other than this, no warranty is implied or intended. Any reliance on the information contained herein by third parties is at such parties' sole risk.

APPENDIX A-1

BORING LOG KEY

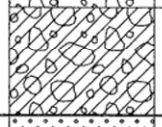
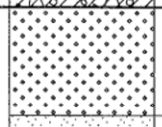
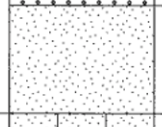
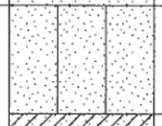
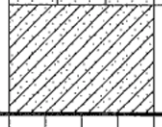
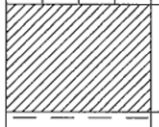
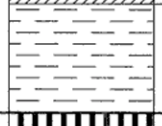
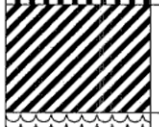
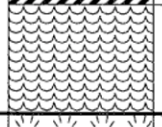
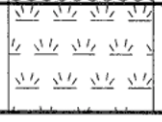
BORING LOG KEY



APPENDIX A-2

UNIFIED SOIL CLASSIFICATION SYSTEM CHART

UNIFIED SOIL CLASSIFICATION SYSTEM CHART

MAJOR DIVISION			SYMBOL GRAPH	SYMBOL LETTER	GROUP NAME[A] AND TYPICAL DESCRIPTION
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL RETAINED ON NO. 200 SIEVE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)		GW[B]	**WELL-GRADED GRAVEL**[C]: GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP[B]	**POORLY-GRADED GRAVEL**[C]: GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (MORE THAN 15% FINES)		GM[B]	**SILTY GRAVEL**[C]: GRAVEL - SAND - SILT MIXTURES
				GC[B]	**CLAYEY GRAVEL**[C]: GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)		SW	**WELL-GRADED SAND**[D]: GRAVELLY SANDS, LITTLE OR NO FINES
				SP	**POORLY-GRADED SAND**[D]: GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (MORE THAN 15% FINES)		SM	**SILTY SAND**[D]: SAND - SILT MIXTURES
				SC	**CLAYEY SAND**[D]: SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL PASSES THE NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	**SILT**[E]: INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	**LEAN CLAY**[E]: INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	**ORGANIC CLAY/ORGANIC SILT**[E]: ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT 50 OR GREATER		MH	**ELASTIC SILT**[E]: INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	**FAT CLAY**[E]: INORGANIC CLAYS OF HIGH PLASTICITY
				OH	**ORGANIC CLAY/ORGANIC SILT**[E]: ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	**PEAT**: HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTES: A) IF FIELD SAMPLE CONTAINS COBBLES OR BOULDERS, ADD "WITH COBBLES" AND/OR "WITH BOULDERS" TO GROUP NAME
B) DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS WITH 5-15% FINES. ADD "WITH SILT" OR "WITH CLAY" TO GROUP NAME
C) IF SOIL CONTAINS 15% OR MORE SAND, ADD "WITH SAND" TO GROUP NAME
D) IF SOIL CONTAINS 15% OR MORE GRAVEL, ADD "WITH GRAVEL" TO GROUP NAME
E) IF SOIL CONTAINS 30% OR MORE PLUS NO. 200, ADD "SANDY" OR "GRAVELLY" TO GROUP NAME. IF 15-25%, ADD "WITH SAND" OR "WITH GRAVEL", WHICHEVER IS PREDOMINANT.

APPENDIX B

SITE HEALTH AND SAFETY PLAN

APPENDIX B
SITE HEALTH AND SAFETY PLAN

GEORGIA-PACIFIC CALIFORNIA WOOD PRODUCTS
MANUFACTURING FACILITY
90 WEST REDWOOD AVENUE
FORT BRAGG, CALIFORNIA
AME PROJECT NO. 16017.07

June 8, 2005

PREPARED BY:

Mark W. Clardy

Mark Clardy, R.G.
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Project Geologist

Date 6/8/05

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REVIEWED BY:

Michael Acton
Project Health and Safety Manager

Date 6-8-05

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SITE HEALTH AND SAFETY PLAN

GEORGIA-PACIFIC CALIFORNIA WOOD PRODUCTS
MANUFACTURING FACILITY
90 WEST REDWOOD AVENUE
FORT BRAGG, CALIFORNIA
AME PROJECT NO. 16017.07

June 8, 2005

1.0 PROJECT INFORMATION

1.1 Introduction

Georgia-Pacific Corporation (G-P) authorized the preparation of this site Health and Safety Plan (HASP) for the former Georgia-Pacific California Wood Products Manufacturing Facility located at 90 West Redwood Avenue, Fort Bragg, California (site), which is currently owned by G-P. Site operations ceased in August 2002.

This HASP summarizes health and safety hazard information for activities to be conducted by Acton • Mickelson • Environmental, Inc. (AME) at the site. The elements and requirements of this HASP must be followed by all AME and subcontract personnel and visitors.

2.0 SCOPE OF WORK

Planned work activities at the site include:

Parcel Number	Planned Work Activities
1	• Monitoring well installation and borings with soil and ground water sampling at the Pump House.
2	• Monitoring well installation with soil and ground water sampling at the Resaw Number 5 and Glue Lam Buildings and Helicopter Landing Pad.
3	• Soil borings and grab ground water sampling at the Railroad Spurs, Dry Shed Numbers 4 and 5, Construction Engineering Paint Storage Shed, Former Planer Number 1, Machine Shop/Sheet Metal/Plumbing/Plant Supply building, and the Covered Shed.

Parcel Number	Planned Work Activities
	• Monitoring well installations with soil and ground water sampling at the Former Mobile Equipment Shop.
4	• Borings for sediment sampling at the Ponds.
	• Geophysical survey and soil and ground water sampling at the Hog Fuel Pile.
	• Soil borings, grab ground water sampling, and backhoe excavation at the Former Bunker Fuel Aboveground Storage Tanks.
5	• Soil borings and grab ground water sampling west of and at the Mobile Equipment Shop, Truck Wash, Fuel Storage and Dispenser Building, Tire Shop, Former Oil House, Former Open Refuse Fire, Engine House, and Shingle Mill.
	• Geophysical survey, soil borings, and grab ground water sampling at the Log Pond East Fill Area.
	• Soil sampling at the Transformer Pad.
	• Surface water sampling and borings for sediment sampling at Pond 8.
6	• Soil borings and grab ground water sampling at the Former Hazardous Waste Storage Area, Planer Mill Number 2, Truck Shop, and Shipping Office (Former Vehicle Maintenance Shop).
	• Soil sampling at the Former Aboveground Storage Tank (tentative).
	• Geophysical survey, monitoring well installations, and soil and ground water sampling at the Log Pond West Fill Area.
7	• Soil borings and grab ground water sampling at the Hazardous Materials Storage Area, Teepee Burner, Fuel Aboveground Storage Tanks, former Diesel Aboveground Storage Tank, Generator, and Pump Area near Pond 2.
	• Sediment sampling at the four South ponds.
	• Destruction of existing water wells.
	• Stockpile sampling at the Soil and Ash Stockpiles.

Parcel Number	Planned Work Activities
8	• Geophysical survey and soil borings at the Coastal Disturbance Area. • Soil borings and grab ground water sampling at the Airstrip Fueling Area and Tree Nursery. • Stockpile sample collection at the Clinker Piles.
10	• Stockpile sample collection at the Clinker and Ash Scrap Piles.

The site activities to be conducted during the project are briefly described below.

- Utility Clearance. A utility clearance subcontractor will be used to geophysically assess the presence of subsurface utilities in the areas to be sampled. Underground Services Alert (1-800-642-2444) will be contacted at least 48 hours prior to commencing subsurface activities. Areas where subsurface work will occur will be outlined in white as required by law.

- Soil Sampling. Soil samples will be collected with a Macrocore sampler and Geoprobe-type rig, manual drive sampler, or hand auger. Subsamples for VOC analysis will be collected with an Encore sampler.

- Monitoring Well Installation. Installation of ground water monitoring wells and piezometers with a hollow stem auger drill rig.

- Boring Abandonment. After sampling, the borings will be backfilled with neat cement in accordance with Mendocino County Environmental Health Department and North Coast Regional Water Quality Control Board requirements.

- Surface Water Sampling. Collection of surface water samples with a bailer.

- Ground Water Grab and Well Sampling. Ground water will be sampled from the soil borings (grab samples) and ground water monitoring wells.

- Geophysical Surveys. Performance of geophysical surveys to locate piping and evaluate fill-area limits.

- Pond Sediment and Surface Water Samples. Sediment and surface water samples are to be collected from pond areas. This may require entering marshy areas or sampling through water while floating in a boat.

- Well Destruction. Dismantling and destruction of existing water-supply and monitoring wells will be performed by overdrilling, removing the well casings, and backfilling the resulting holes with neat cement.

3.0 HAZARD ASSESSMENT

The hazards associated with the activities described in Section 2.0 have been separated into two groups: chemical and physical. The characteristics of these hazards as they relate to field investigation activities are discussed below.

3.1 Chemical Hazards

Chemical compounds found to be present in soil and/or ground water during the previous Phase II ESA and additional investigations include:

- Petroleum hydrocarbons (as gasoline, diesel, and motor oil)
- Benzene
- Toluene
- Ethylbenzene
- Xylenes
- Trimethylbenzene
- Methyl tertiary butyl ether (MTBE)
- Tetrachloroethene
- Trichloroethene
- Other Chlorinated Volatile Organic Compounds (VOCs) including chlorobenzene, and isomers of dichloroethene, dichlorobenzene, and dichloroethane
- Cis- and trans-1,2-Dichloroethene (cis- and trans-1,2-DCE)
- 1,1,1-Trichloroethane
- Chlorobenzene
- 2-Butanone (MEK)
- Naphthalene

- Polychlorinated biphenyls (PCBs)
- Pentachlorophenol
- Tetrachlorophenol
- Dioxins and Furans
- Polynuclear Aromatic Hydrocarbons (PAHs)
- CA Title 22 Metals
- Phenol
- Phenol-Resorcinol
- Cyanide
- Fungicide, insecticide, and herbicide

Exposure limits for chemicals of potential concern are included in Table B-1.

3.1.1 Petroleum Hydrocarbons

Petroleum hydrocarbons are generally liquids with a fuel-like odor, such as gasoline, kerosene, diesel, and motor oil. Exposure to petroleum hydrocarbons affects the eyes, skin, respiratory system, and central nervous system. Exposure occurs primarily through inhalation of vapors. Symptoms of exposure include irritation of the eyes, nose, and throat, dizziness, drowsiness, headaches, and nausea. Petroleum hydrocarbons exhibit relatively low acute inhalation and dermal toxicity. The potential for exposure to petroleum hydrocarbons at this site is considered moderate, particularly for diesel and motor oil range compounds.

3.1.2 Benzene

Benzene, an aromatic hydrocarbon, is found in gasoline and other fuels, is a component of products derived from coal and petroleum, and is produced by the burning of natural products. Benzene is used in the manufacture of plastics, detergents, pesticides, and other chemicals. Research has shown benzene to be a carcinogen (cancer causing). Long-term exposure may affect bone marrow and blood production. Breathing benzene can cause drowsiness, dizziness, and unconsciousness. The potential for exposure is considered low.

3.1.3 Toluene

Toluene is a colorless gas that has a sweet, pungent odor. Exposure pathways include inhalation, ingestion, and contact. Symptoms of exposure include irritation to the skin, eyes, and nose, dizziness, drowsiness, headache, and fatigue. The potential for exposure is considered low.

3.1.4 Ethylbenzene

Ethylbenzene is a colorless organic liquid with a sweet, gasoline-like odor. The exposure pathways include inhalation, ingestion, and contact. Symptoms of exposure include drowsiness, fatigue, headache, and mild eye and respiratory irritation. The potential for exposure is considered low.

3.1.5 Xylenes

Xylenes are clear liquids with a sweet odor. Exposure to petroleum hydrocarbons affects the eyes, skin, respiratory system, and central nervous system. Symptoms of exposure include disturbances of cognitive abilities, balance, and coordination. The potential for exposure to xylenes at this site is considered low to moderate.

3.1.6 Trimethylbenzene

Trimethylbenzenes are used as solvent and intermediates in the manufacture of paint thinners, perfumes, dyes, and a motor fuel additive. Inhalation is the primary exposure pathway, although skin absorption also occurs. Exposure can cause headaches, fatigue, nausea, and eye irritation. Direct contact can cause skin irritation and asthmatic bronchitis. The potential for exposure is considered low.

3.1.7 Methyl Tertiary Butyl Ether

MTBE is a flammable liquid with a distinctive, turpentine-like odor. It is made from blending isobutylene and methanol and used as an unleaded gasoline additive to achieve more efficient burning. Breathing small amounts of MTBE for short periods of time may cause nose and throat irritation. People exposed to gasoline containing MTBE may experience headaches, nausea, dizziness, and mental confusion. There is no evidence that MTBE causes cancer in humans, although studies have demonstrated that breathing high levels of MTBE for long periods may cause kidney cancer in rats and liver cancer in mice. The potential for exposure is considered low to moderate.

3.1.8 Other Chlorinated Volatile Organic Compounds Including Tetrachloroethene, Trichloroethene, Chlorobenzene, and Isomers of Dichloroethene, Dichlorobenzene, and Dichloroethane

Numerous chlorinated VOCs are present at the site. Many of these compounds are possible or suspected human carcinogens. VOCs can be gaseous (colorless), liquid (dissolved in ground water), or solid (contaminated soil). These compounds are typically relatively volatile and have a chloroform-like odor. The most likely exposure pathways at the site are inhalation, ingestion, and skin contact with contaminated soil or ground water. Symptoms of exposure include irritation to the eyes, skin, and respiratory system. The potential for exposure is considered low.

3.1.9 2-Butanone

2-Butanone (also known as methyl ethyl ketone or MEK) is a colorless liquid with a sharp, sweet odor. It is used in paints and glues and as a cleaning agent, though it also occurs naturally in some trees. The compound causes mild irritations of the skin, eyes, nose, and throat. The potential for exposure is considered low.

3.1.10 Naphthalene

Naphthalene is a white solid that evaporates easily and is found naturally in burning fuels. It is used in mothballs and moth flakes and is also a product of burning wood or tobacco. It has a strong and unpleasant odor. Exposure symptoms at high concentrations include nausea, vomiting, diarrhea, blood in the urine, and yellowing skin. The potential for exposure is considered low.

3.1.11 Polychlorinated Biphenyls

PCBs are chlorinated compounds that can consist of mixtures of more than 200 individual compounds. PCBs occur as either oily liquids or solids that are colorless to light yellow, though they can also exist in gaseous form (air vapors). The compounds have no known smell or taste. PCBs have been used as coolants and lubricants in transformers and capacitors. The United States Environmental Protection Agency (EPA) classifies PCBs as carcinogens, particularly to the liver. Exposure can be through inhalation or skin contact. Irritation may result in skin lesions, rashes, and burning eyes. The potential for exposure is considered low.

3.1.12 Pentachlorophenol

Pentachlorophenol is a manufactured chemical used as a pesticide and wood preservative. Exposure to high levels of pentachlorophenol can cause increases in body temperature, liver effects, damage to the immune system, reproductive effects, and developmental effects. The potential exposure is considered low.

3.1.13 Tetrachlorophenol

Tetrachlorophenol is used for the control of sapstain fungus in wood, which causes the wood to absorb water, leading to accelerated decay. Symptoms of exposure may include cough, sore throat, dry skin, redness of skin, burning sensation, pain, redness and pain in the eyes, abdominal pain, diarrhea, headache, dizziness, vomiting, weakness, convulsions, muscular spasms, increased body temperature, and sweating. The potential for exposure is considered low.

3.1.14 Dioxins and Furans

Dioxins and furans refer to a group of chlorinated organic chemicals. They are formed unintentionally and are predominately released as byproducts of human activities (e.g., incineration and fuel combustion). Dioxins and furans travel through the air and deposit on water and land. Animals accumulate dioxins and furans in fat through their food, and

concentrations increase up the food chain. These toxins tend to accumulate in the fat and liver. Dioxins and furans increase the risk of cancer, diabetes, liver and heart diseases, skin problems, fatigue, malaise, and slowed nervous reactions. The potential for exposure is considered low.

3.1.15 Polycyclic Aromatic Hydrocarbons

PAHs are produced whenever substances are burned. Breathing smoke or coming in contact with contaminated soil exposes humans to PAHs. Short-term health effects may include eye irritation, nausea, vomiting, diarrhea, and confusion. Long-term health effects may include, cataracts, jaundice, and kidney and liver damage. The potential for exposure is considered low to moderate.

3.1.16 Title 22 Metals

Title 22 metals include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc. Nine metals commonly found in burn-ash are

- Arsenic: Arsenic can cause bone marrow suppression and is known to be fatal in large amounts.
- Beryllium: Beryllium can cause chemical pneumontis, the symptoms of which include cough, substernal burning, shortness of breath, anorexia, and increasing fatigue.
- Cadmium: Respiratory exposure to cadmium can cause kidney and liver damage, bone marrow diseases, and emphysema.
- Chromium: Hexavalent chromium is associated with cancer risk, kidney damage, and potential lung tumors.
- Copper: Copper poisoning is rare in humans, but there is evidence that copper may have a negative impact on the reproductive system.
- Lead: Lead poisoning may result in anorexia and in severe cases permanent brain damage.
- Mercury: Many mercury compounds are irritating to the skin. Mercury deposits in human kidneys may result in renal failure.
- Nickel: Nickel is toxic to humans and may affect the nasal cavities, lungs, and skin.
- Zinc: Excessive dietary intake of zinc can lead to copper and iron deficiencies, nausea, vomiting, fever, headache, tiredness, abdominal pain, and skin irritation.

The potential for exposure at concentrations of concern is considered low.

3.1.17 Phenol

The primary use of phenol is in the production of phenolic resins, which are used in the plywood, construction, automotive, and appliance industries. The acute effects of phenol exposure include irritation to the skin, eyes, and mucous membranes. Chronic effects of exposure include anorexia, progressive weight loss, diarrhea, vertigo, salivation, gastrointestinal irritation, and blood and liver effects. The potential for exposure is considered low.

3.1.18 Phenol-Resorcinol

Phenol-Resorcinol is used in the wood-lamination industry. Chronic health hazards due to exposure may cause allergic contact dermatitis and respiratory sensitization and may be associated with nasal cancer. The potential for exposure is considered low.

3.1.19 Cyanide

The primary source of cyanide is from car exhaust. Other airborne sources include emissions from chemical processing and industrial and municipal waste incinerators. In the project area, Log Pond sediments may contain cyanide from the scrubber effluent. Acute effects of cyanide exposure can be weakness, headache, nausea, respiration increase, eye and skin irritation, or death. Chronic exposure may result in headaches, numbness, tremor, loss of visual acuity, cardiovascular and respiratory effects, an enlarged thyroid, and irritation to the eyes and skin. The potential for exposure is considered low.

3.1.20 Fungicide, Insecticide, and Herbicide

Fungicides, insecticides, and herbicides have been applied within the site Nursery. Soil and ground water in that area may contain residual amounts of those products. Exposure can occur through skin contact, inhalation, or ingestion. Exposure to harmful amounts of pesticides can cause eye damage, skin irritation, respiratory irritation, liver damage, nausea, diarrhea, and effects to the central nervous system. The potential for exposure is considered low to moderate.

3.2 Physical Hazards

Physical hazards associated with the scope of work include:

- Motorized equipment operation
- Noise exposure
- Underground utilities
- Confined spaces
- Slipping, tripping, and falling
- Drilling activities on a barge
- Biohazards

3.2.1 Motorized Equipment Operation

Hazards associated with concrete-coring equipment operation include pinch points, impact from moving parts, and electrocution from buried utilities. The potential for exposure to motorized equipment hazards is high during concrete demolition, drilling, and excavation activities.

3.2.2 Noise Exposure

Excessive noise exposure can cause temporary and permanent hearing effects. Temporary effects of excessive noise include ringing in the ears, interference with communication, and hearing threshold changes. The effects of long-term excessive noise include varying degrees of noise-induced hearing loss. The potential of exposure to hazardous noise levels is high during heavy-equipment operation.

3.2.3 Underground Utilities

Intrusive activities present the risk of contact with underground utilities (e.g., energized electric lines, gas lines, or sewer lines). Contact with electricity can produce shocks, burns, and death. Gas or sewer lines can contain hazardous levels of explosive or toxic gases. Transite water-conveyance lines contain asbestos. The potential of utility-hazard exposure is considered probable during intrusive activity.

3.2.4 Confined Spaces

A space is considered confined if it exhibits all three of the following characteristics:

- Not designed for continuous human occupancy
- Has limited or restricted entry or exit
- Is large enough and configured so a person can bodily enter the space to perform work

Permit-required confined spaces have any one of the following characteristics:

- Contain or potentially contain a hazardous atmosphere
- Contain a material that has the potential for engulfment
- Have an internal configuration such that the entrant could be trapped or asphyxiated by inwardly converging walls, or a floor that tapers downward to a small cross-section
- Contain any other recognized serious safety or health hazard

A hazardous atmosphere is one that may expose workers to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from one or more of the following:

- Flammable gas, vapor, or mist in excess of 10 percent of its lower exposure limit (LEL) or lower flammable limit (LFL)

- Airborne combustible dust at a concentration that meets or exceeds the LEL or LFL
- Atmospheric oxygen concentration less than 19.5 percent or greater than 23.5 percent
- Atmospheric concentrations of any substance for which there is a permissible exposure limit (PEL) or published dose that could result in worker exposure in excess of its PEL or dose
- Immediately dangerous to life and health conditions

Excavations that are greater than 2.5 feet deep are considered to have limited or restricted access and are therefore confined spaces. Excavations could have a potentially hazardous atmosphere because they are low points that could accumulate heavier gases such as carbon dioxide, thereby creating an oxygen-deficient atmosphere.

3.2.5 Slip, Trip, and Fall

Slip, trip, and fall hazards are potentially present at all project sites. Uneven ground surfaces presented by rocks, vegetation, and animal burrows can be present. Within building areas, construction debris, wet surfaces, and other materials can be present and result in an unexpected fall.

3.2.6 Drilling Activities on a Barge

Normal drilling hazards such as moving parts and noise are increased on a barge because of the restricted working area. The drilling crew may not perform barge work on a regular basis; therefore, extra precaution should be taken when performing routine tasks. There is a potential of falling overboard, glare, insects, and motion sickness.

3.2.7 Biohazards

Site biological hazards include:

- Bees and wasps
- Rattlesnakes
- Poisonous spiders
- Ticks
- Poison oak

3.2.7.1 Bees and Wasps

Bees and wasps are common from mid-spring to fall. These insects are typically not aggressive but may deliver a sting or a bite if threatened. Usually bites and stings cause only local discomfort; however, individuals allergic to the venom may go into anaphylactic shock, which if untreated can rapidly result in death.

3.2.7.2 Rattlesnakes

The site is within the habitat of the Northern Pacific Rattlesnake, which may attain a length of up to 5 feet, is generally brownish to gray in color, has a triangular head, and may or may not possess rattles. Rattlesnakes are generally active from April through September and are mainly nocturnal, although they are active in the spring and may be found sunning themselves on warm mornings. On hot days, snakes retreat to their dens or other shady areas. When striking, a snake may or may not inject venom.

3.2.7.3 Poisonous Spiders

Poisonous spiders, in particular the Black Widow spider, inhabit dark, cluttered areas. These spiders have been found in monitoring well Christie boxes and stand pipes. Black Widow spiders are not aggressive but have a very potent, neurotoxic venom that can be injected if the animal feels threatened.

3.2.7.4 Ticks

Ticks are parasitic insects that are quite common in areas where deer and other wildlife are present. Ticks hang on vegetation and wait for a passing host to which they can attach. Once attached to a person, the tick will crawl to an area of exposed skin, bury its mouth parts, and begin to feed. The saliva of ticks may contain bacteria associated with Lyme Disease. Ticks may be present in three stages: larval, nymph, and adult. Each stage needs to feed to advance to the next stage.

3.2.7.5 Poison Oak

Poison Oak normally occurs as a low bush, but may also form as a vine. It is characterized by three oak-leaf shaped leaves and may become red-colored in the fall. In the winter, the leaves fall off and only the bare branches remain.

4.0 HEALTH AND SAFETY REQUIREMENTS

4.1 Personnel Training and Medical Clearance

All work involving structures with asbestos and lead-containing paint will be performed in general accordance with local, state, and federal rules and regulations. A certified and trained contractor will be utilized to secure the necessary permits and conduct the required abatement activities. These tasks will be conducted as part of aboveground structure removal, which is outside the scope of work addressed by the Work Plan. However, there is the potential for contact with subsurface water pipes wrapped with asbestos-containing material during the subsurface disturbance activities described herein. In such an event, the aforementioned procedures would be implemented.

Personnel working at the site must comply with the following health and safety requirements:

- Completion of the OSHA Hazardous Waste Operations and Emergency Rescue (HAZWOPER) 40-hour basic training, or for the occasional site worker, completion of the HAZWOPER 24-hour basic training.

- Completion of the 8-hour annual HAZWOPER refresher

- Participation in a medical surveillance program

- Certification in First Aid and Cardio Pulmonary Resuscitation

4.2 Health and Safety Briefing

Prior to the start of field activities, a site health and safety briefing will be conducted by the Site Health and Safety Officer (SHSO) for all onsite workers, including subcontractors. At a minimum, the following topics will be discussed:

- Health and safety personnel names and responsibilities
- Site hazards
- Personnel protective clothing
- Safe work practices
- Personnel and equipment decontamination procedures
- Air monitoring
- Emergency procedures

Daily "tailgate" health and safety meetings will be conducted to address any changes in procedures and to reinforce positive behavior.

4.3 Health and Safety Documentation

Personnel that have attended the site health and safety briefing will sign the form included in Appendix B-1. Daily tailgate health and safety meetings will also be documented by collecting the signatures of all personnel who attended the meeting.

4.4 Chemical Hazard Mitigation

4.4.1 Air Monitoring

The presence of VOCs and petroleum hydrocarbons will be evaluated with onsite air-monitoring equipment. A photoionization detector calibrated to isobutylene will be used to monitor the breathing zone of workers. Work will be initiated with Level D protection. A PID reading of 1 part per million in the workers' breathing zone sustained for 2 minutes will prompt an upgrade to Level C protection or evacuation of the area.

4.4.2 Dust Suppression

The formation of dust creates a condition that increases the potential for inhalation and body contact, which are exposure pathways for many of the chemicals that could potentially be encountered at the site; therefore, by suppressing dust generation the potential for a chemical exposure is decreased.

If necessary, stockpiled soil may be wetted with water to suppress dust generation. In addition, stockpiled soil will be covered with plastic to suppress dust generation.

If a large cloud of dust is generated, personnel will leave the work area and return only after the dust has settled. Water will be applied to the drill bit during concrete coring activities to suppress the generation of dust. Cement mixing will be performed with a paper half-face dust mask.

4.4.3 Ingestion

Eating, drinking, chewing gum or tobacco, or any other practice that increases hand-to-mouth transfer and ingestion of material is prohibited unless proper decontamination procedures have been implemented (Section 4.7). Smoking is not permitted at the site.

4.5 Physical Hazard Mitigation

4.5.1 Motorized Equipment Operation

Prior to drilling inside pits, the atmosphere inside the pit will be monitored for the presence of combustible gas. The following will be implemented to avoid hand injuries:

- Pinch points. Danger zones are found between a moving object and stationary object or between two continuous moving objects. Avoid placing your hand in these danger zones.

- Hot spots. Certain types of machinery (e.g., air compressors) have built-in heaters or generate heat. Hot areas on these machines can cause serious burns. Protective gloves can protect your hands from hot machinery.

- Rotary machine surfaces. Rotating devices such as drill bits, saw blades, and milling cutters can be extremely hazardous to hands. Avoid placing your hands in these danger zones.

- Automated machinery. Be alert when working around automated machinery. Relays, delay timers, remote controllers, and robotics can cause machinery to start up suddenly even when it appears to be turned off.

- Jewelry and loose clothing. Jewelry and shirtsleeves can easily get caught in moving machinery. Always remove all jewelry before beginning work and make sure shirt sleeves are rolled up above the elbow.

- Other hand hazards. Keep your hands out of the space between a doorjamb and a rolling cart. Watch your hands around forklift operations. Wear gloves while moving heavy objects, and be aware that losing control of something heavy can cause smashed hands.

- Hand tools. Using the wrong tool for a job or using the right tool in the wrong way can result in a serious hand injury. Inspect your tools carefully before using them and throw away any tool that appears unsafe. Also, never apply unnecessary pressure when using tools.

- Use a vise or flat surface. Never hold an object you are working on in your hand.

- Knives. Keep blades well sharpened. Always cut away from your body. Use a retractable knife blade when possible. Never use a knife as a screwdriver. Make sure you have plenty of space around you when working with a knife. Never work on the same piece of material with a co-worker who is using a knife. Knives should never be stored in drawers. Store knives separately from other tools, and keep blades turned down. Never leave a knife lying around. When carrying a sheath knife on your belt, make sure the sheath is over your hip with the knife blade facing back.

- Machine safeguards. Many machines have built-in safeguards to protect your hands and other body parts from hazards. Never remove a safeguard. Never operate machinery that has had any safeguards removed.

- Use a magnet attached to a stick to remove a piece of metal from a machine.

- Use pliers, not your fingers, to hold small metal objects that need to be ground or held near a cutting surface.

- Protective gloves. Wearing appropriate gloves is an important part of protecting yourself from hand hazards, but you should also be aware when not to wear them.

  - Wear gloves when working with hot machinery, knives, and hand tools unless advised not to.

  - Wear the proper gloves when working around chemicals such as cleaning fluids, acids, or solvents. If your hand accidentally comes in contact with a hazardous chemical, rinse the area well with cool water and seek medical attention immediately.

  - Never wear gloves when working near machine gears or other devices in which the glove could get caught.

- Avoid getting near any moving objects. When working around drilling equipment or backhoes, always stay where the operator can see you.

4.5.2 Noise Exposure

Hearing protection is required when any site activity produces noise loud enough to make conversation difficult without raising the voice at a distance of 3 feet.

4.5.3 Underground Utilities

To decrease hazards associated with intrusive-work subsurface-utility encounters, Underground Service Alert will be notified at least 48 hours before intrusive work startup. A utility clearance subcontractor will be used to locate subsurface utilities in planned investigation areas.

4.5.4 Confined Spaces

Entry into a permit-required confined space is prohibited. Excavations that are greater than 2.5 feet deep are considered to have limited or restricted access and are therefore confined spaces; however, the condition of limited or restricted access may be removed by installing a plywood ramp, thereby turning a confined space into a work area. Under no circumstances will personnel enter an excavation more than approximately 5 feet deep.

The atmosphere inside the pit will be monitored prior to entry by lowering an oxygen meter and a combustible gas meter into the excavation. Audible alarms on the monitoring equipment may be used as needed. This testing will be used to determine if the excavation atmosphere represents a hazardous condition. Atmosphere within an excavation will not be considered hazardous if:

1. No oxygen-deficient atmosphere exists inside the excavation
2. No combustible materials are present at potentially hazardous concentrations

The buddy system will be used when working or sampling in the vicinity of confined spaces.

4.5.5 Slip, Trip, and Fall

Slip, trip, and fall hazards can be mitigated by taking time to carefully survey the terrain in front and to the sides of a work area to avoid or negotiate uneven ground and other debris.

4.5.6 Drilling Activities on a Barge

Drilling activities on a barge often involve confined work areas, proximity to moving parts, and crew-member inexperience; therefore, choosing and not moving from a safe work station is recommended. Minimizing movement will help prevent falling overboard. A Coast Guard-approved life vest should be worn at all times. Sun screen should be worn for protection from the sun, and Dramamine or its equivalent may be taken for motion sickness if necessary. Mosquitoes may be present within pond or swampy areas and their attacks may be reduced by repellant application; however, care should be taken not to apply chemicals that may compromise the sample integrity.

4.5.7 Biohazards

4.5.7.1 Bees and Wasps

To reduce the possibility of being stung or bitten by bees and wasps, be aware of their presence. If there are unusual amounts of bees or wasps, there may be a hive nearby, so avoid the area. Long-sleeved shirts and beekeeping veils will protect arms and faces. If stung or bitten, over-the-counter medicines are available to reduce discomfort. If an individual who is allergic to bee stings is stung and begins to go into anaphylactic shock, an injectible epinephrine should be administered. Persons allergic to bee stings should never be onsite alone and always near a sting kit containing epinephrine.

4.5.7.2 Rattlesnakes

Brushy areas where the ground is not visible should be avoided to prevent stepping on rattlesnakes. Snakes often crawl beneath boards and other objects to avoid the hot sun, so care should be taken when moving these objects. If bitten by a rattlesnake, stay calm, gently wash the bite area with soap and water, remove anything that may constrict swelling, apply a cold wet cloth over the bite, and travel safely to the nearest emergency room.

4.5.7.3 Poisonous Spiders

To avoid spiders, care should be taken when opening monitoring wells or entering vacant buildings. Poisonous spider-bite symptoms range from nothing noticeable to intense pain. For first aid, remain calm, apply an ice pack directly to the bite, and seek medical attention, taking the spider along for identification.

4.5.7.4 Ticks

Any brushy or grassy areas may contain ticks. If a tick has attached itself to the skin and is feeding, it may be removed with an aerosol insect repellant containing pyrethrin (after 1 minute, spray again) and by dabbing with Lyclear, a scabies cream. The combination of hydrocarbons and pyrethrin acts as a narcotic and prevents the tick from secreting saliva. The tick should fall off within 24 hours.

4.5.7.5 Poison Oak

To avoid Poison Oak, do not enter brushy areas. If the leaves or stem of a Poison Oak bush are touched, wash the affected area with resin-cutting soap as soon as possible. Clothing or animals that have come in contact with Poison Oak resin can still be infective. Many over-the-counter medicines (e.g., Tecnu Oak-n-Ivy) are available for symptomatic relief.

4.6 Personal Protective Equipment

It is anticipated that all field activities will be conducted in Level D personal protective equipment, which includes safety glasses, steel-toed work boots, and hearing protection and hard hats as needed. A hard hat is required when working with or around motorized drilling equipment. Gloves are required during soil sampling activities. Nitrile gloves are resistant to degradation by petroleum compounds, alcohols, and caustics and are therefore appropriate for site use. Respirators will be used if air monitoring indicates the presence of VOCs in the breathing space (Section 4.4.1).

4.7 Decontamination

Sampling equipment will be decontaminated between sample locations by washing in a bucket containing tap water and surfactant. The equipment will be double rinsed with tap water prior to use. Gloves will be replaced between sampling locations. Hands and face will be washed with soap and water at the end of each work shift, or more frequently as needed.

5.0 EMERGENCY INFORMATION

Emergency telephone numbers (Table B-2) will be kept readily available in field-activity support vehicles and made accessible to each onsite worker. Emergencies will be reported to the AME Project Manager immediately. Field personnel will not converse with the press regarding site activities.

5.1 Hospital Route

The closest hospital providing emergency-room services is:

Mendocino Coast District Hospital
760 River Drive
Fort Bragg, California 95437
(707) 961-1234

Figure B-1 is a map showing the route to the hospital from the site. The route is:

Exit the site via the main gate onto Cypress Street and proceed east approximately 0.3 mile to River Drive. Hospital is on the right at the southeast corner of Cypress Street and River Drive.

5.2 Emergency Medical Procedures

For severe injuries, illnesses, or overexposures:

- Remove the injured or exposed person(s) from immediate danger.
- If possible, complete at least partial decontamination. Wash, rinse, and cut off protective clothing and equipment and redress the victim in clean clothes.
- If decontamination cannot be conducted, wrap the victim in blankets or plastic sheeting to reduce contamination of other personnel.
- Call an ambulance for transport to a local hospital immediately and notify emergency personnel of on-site contaminants.
- Evacuate other on-site personnel to a safe place until the AME Health and Safety Officer determines that it is safe to resume work.
- Report the accident to the AME Project Manager immediately.

For minor injuries or illnesses:

- Complete a full decontamination.
- Administer first aid. Minor injuries may be treated on site, but all injuries will be examined by trained medical personnel.

5.2.1 First Aid – Chemical Injury

If the injury to the worker is chemical in nature (e.g., overexposure), the following first aid procedures are to be instituted as soon as possible:

- Eye exposure. If contaminated solid or liquid gets into the eyes, wash eyes immediately with sterile saline solution or fresh water. A portable eyewash station is located on the AME field vehicle. If a saline solution is unavailable, lift the lower and upper lids occasionally. Continue to wash eyes for 15 minutes. Cover eyes with a dry pad and obtain medical attention immediately. Contact lenses are not permitted in the exclusion zone. Portable eye wash bottles will be available in the construction area.
- Skin exposure. If contaminated solid or liquid gets on the skin, promptly wash contaminated skin for 15 minutes using water and soap or mild detergent. If solids or liquid penetrate through the clothing, remove the clothing immediately and wash the skin using water and soap or mild detergent. Obtain medical attention immediately if symptoms warrant.

- Chemical inhalation. If a person exhibits symptoms of chemical inhalation, move the exposed person to fresh air at once. If breathing has stopped, perform rescue breathing. Keep the affected person warm and at rest. Obtain medical attention as soon as possible.

- Chemical ingestion. Call the poison control center at 1-800-222-1222. If contaminated solid or liquid has been swallowed and is a corrosive material or a hydrocarbon, **do not** induce vomiting. Otherwise, if the person is conscious, feed the person an approved vomiting inducing substance such as Ipecac. Obtain medical attention immediately.

5.2.2 First Aid – Physical Injury

The following are first-aid procedures for physical injuries:

- Burns (minor). Do not apply Vaseline or grease of any kind. Apply clean, cold water until pain subsides. Cover with a wet sterile gauze dressing. Do not break blisters or remove tissue. Seek medical attention.

- Burns (severe). Do not remove adhered particles of clothing. Do not apply ice or immerse in cold water. Do not apply ointment, grease, or Vaseline. Cover burns with thick sterile dressings. Keep burned feet or legs elevated. Seek medical attention immediately.

- Cuts. Apply pressure with sterile gauze dressing and elevate the area until bleeding stops. Apply a bandage and seek medical attention.

- Puncture wounds. If puncture wound is deeper than the skin surface, seek medical attention. Serious infection can arise unless proper treatment is received.

- Fracture. Deformity of an injured part usually means a fracture. If a fracture is suspected, splint the part as it lies. Do not attempt to move the injured part. Seek medical attention immediately.

- Sprains. Elevate injured part and apply ice bag or cold packs. Do not soak in hot water. If pain and swelling persists, seek medical attention.

- Unconsciousness. Never attempt to give anything by mouth. Keep victim flat and maintain an open airway. If victim is not breathing, provide rescue breathing and call for medical assistance immediately.

- Fainting. Keep the victim lying down with feet elevated. Loosen tight clothing. If the victim vomits, roll him or her onto his or her side or turn his or her head to the side. If necessary, wipe out his or her mouth. Maintain an open airway. Bathe the face gently with cool water. Unless recovery is prompt, seek medical attention.

- Objects in eyes. Keep the victim from rubbing the eye. Flush the eye with water. If flushing fails to remove the object, apply a dry, protective dressing and seek medical attention.

5.3 Fire or Explosion

In the event of a fire or explosion, the local fire department will be summoned immediately. The AME SHSO will advise the fire commander of the location, nature, and identification of the hazardous materials on site.

If it is safe to do so (i.e., the fire is small and immediately extinguishable), trained site personnel may:

- Use on-site fire fighting equipment to control or extinguish the fire
- Remove or isolate flammable or other hazardous materials that may contribute to the fire

Otherwise, evacuate the area immediately.

In the event of an explosion, all personnel will be evacuated and the fire department notified. No one will re-enter the area until it has been cleared by explosives safety personnel.

In the event of a site evacuation, all personnel present at the site will meet at the former G-P office onsite. All onsite personnel must be accounted for by the AME SHSO prior to leaving the site.

The AME Project Manager will be notified of work stoppages due to a natural disaster or other mandated site evacuation.

5.4 Emergency Equipment

Emergency equipment will be stored in support vehicles and/or at appropriate locations selected during site mobilization. Emergency-response equipment will be moved from one site to another based on changing field-activity locations so that emergency equipment is available in the work area. The following emergency equipment will be available onsite:

- At least one 20-pound A/B/C-type fire extinguisher for the site, and one 10-pound A/B/C-type fire extinguisher in each vehicle

- At least one fully stocked industrial first-aid kit provided and maintained in the support zone

- Potable water

- Emergency eye wash station

- Cellular phone

TABLE B-1
EXPOSURE LIMITS FOR CHEMICALS OF POTENTIAL CONCERN

Chemical Name	TWA	IDLH
1,1,1-trichloroethane	350 ppm	700 ppm
1,2-, 1,3-, and 1,4-dichlorobenzene	50 ppm	150 ppm
2-butanone (MEK)	200 ppm	ND
Benzene	1 ppm	500 ppm
Cadmium, dust, and fume	0.005 mg/m^3	9 mg/m^3
Chlorobenzene	75 ppm	1,000 ppm
cis- and trans-1,2-dichloroethene	200 ppm	1,000 ppm
Cyanide	10 ppm	50 ppm
Dioxins	varies by type	ND
Ethylbenzene	100 ppm	800 ppm
Lead	0.050 mg/m^3	100 mg/m^3
MTBE	40 ppm	ND
Naphthalene	10 ppm	250 ppm
O, m, p-xylenes	100 ppm	900 ppm
Pentachlorophenol	0.5 mg/m^3	2.5 mg/m^3
Petroleum hydrocarbons	300 ppm	ND
Phenol	19 mg/m^3	960 mg/m^3
Polychlorinated biphenyls	0.5 mg/m^3	5 mg/m^3
Tetrachloroethene	100 ppm	150 ppm
Tetrachlorophenol	ND	ND
Toluene	200 ppm	500 ppm
Trichloroethene	100 ppm	1,000 ppm
Trimethylbenzene	25 ppm	ND

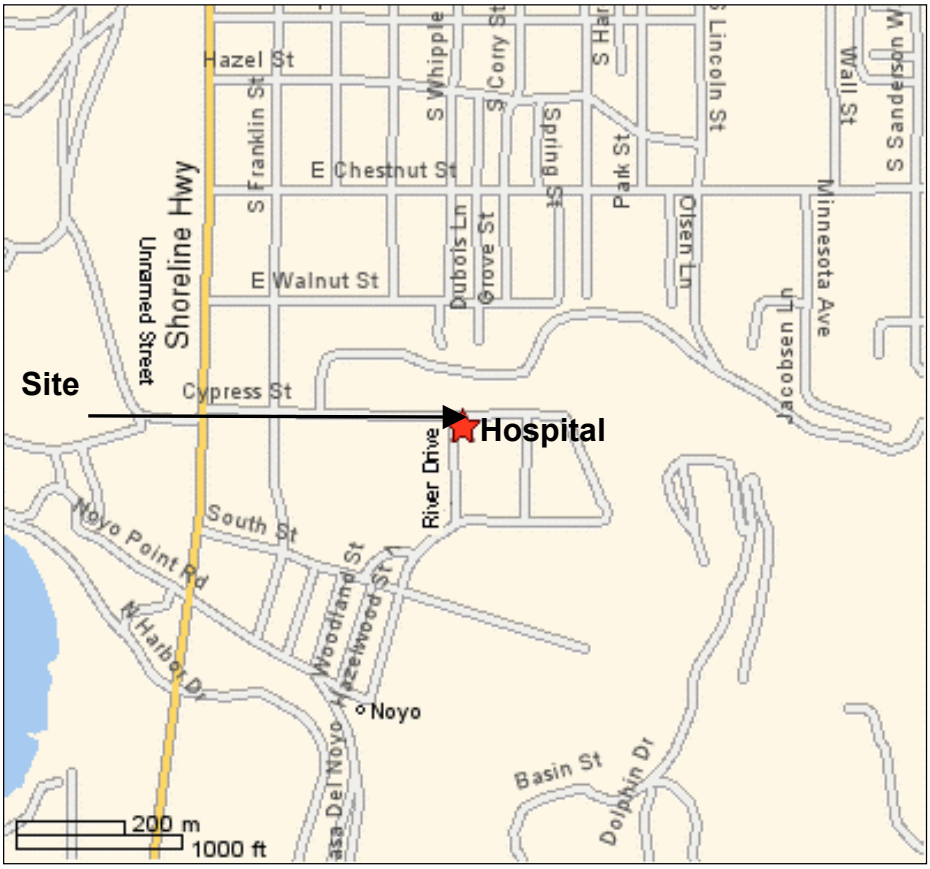
IDLH = Immediately Dangerous to Life or Health
mg/m^3 = milligram(s) per cubic meter
MTBE = methyl tert-butyl ether
ND = not determined
ppm = parts per million
TWA = Time weighted average

TABLE B-2
EMERGENCY CONTACT INFORMATION

LOCAL EMERGENCY TELEPHONE NUMBERS (INCLUDE AREA CODES):	
Ambulance	911 or (707) 961 - 1234
Hospital Emergency Room	911 or (707) 961 - 1234
Poison Control Center	911 or (800) 222 - 1222
Fire Department	911 or (707) 961 - 2831
Police Department	911 or (707) 961 - 2800
NOTE: If you list 911, check to be sure it is activated in the site area and determine whether it is enhanced.	

EMERGENCY CONTACTS	**Phone Number (include area codes)**	
	Work Phone	**Home Phone**
Project Manager: James Twiford	(916) 939 - 9107	(916) 863 - 0966
Principal-in-Charge: Michael Acton	(916) 939 - 9102	(530) 676 - 5343
Site Health and Safety Officer: Dennis Jones	(916) 939 - 9155	(530) 742 - 4260
Site Contact: Doug Heitmeyer	(707) 961 - 3353	( ) -
Regulatory Consultant: Craig Hunt	(707) 530 - 3767	( ) -

FIGURE B-1
ROUTE TO HOSPITAL



Route to Hospital (Mendocino Coast District Hospital, 700 River Drive, Fort Bragg, CA 95437):
Exit the site via the main gate onto Cypress Street and proceed east approximately 0.3 mile to River Drive. Hospital is on the right at the southeast corner of Cypress Street and River Drive.
Phone: (707) 961-1234

APPENDIX B-1

HEALTH AND SAFETY DOCUMENTATION FORMS

SIGNATURES OR REVIEWERS/FIELD CREW: Signature indicates that this person has reviewed and understands all segments of the Site Health and Safety Plan.	
Signature	**Date**

ACTON • MICKELSON • ENVIRONMENTAL, INC.
SITE HEALTH AND SAFETY PLAN
DAILY REVIEW AND ATTENDANCE RECORD

Location:	Date/Time:
Temperature:	Wind Speed/Direction:
General Weather Conditions:	

SIGNATURES OR REVIEWERS/FIELD CREW

Signature indicates that this person has reviewed and understands all segments of the HASP, agrees to abide by the HASP safety rules and guidelines, and has received and completed the appropriate training as required by the HASP.

Name	Signature	Company

Meeting Conducted By: Name_____ Print Name Signature_____	**Site Health and Safety Officer (SHSO):** Name_____ Print Name Signature_____

Tracking: ☐ SHSO ☐ Site Tailgate Safety Meeting File ☐ Project File

APPENDIX C

QUALITY ASSURANCE PLAN

APPENDIX C
QUALITY ASSURANCE PLAN

FORMER GEORGIA-PACIFIC CALIFORNIA WOOD PRODUCTS
MANUFACTURING FACILITY
90 WEST REDWOOD AVENUE
FORT BRAGG, CALIFORNIA
AME PROJECT NO. 16017.07

June 8, 2005

Prepared By

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FORMER GEORGIA-PACIFIC CALIFORNIA WOOD PRODUCTS MANUFACTURING FACILITY
90 WEST REDWOOD AVENUE
FORT BRAGG, CALIFORNIA
AME PROJECT NO. 16017.07

June 8, 2005

1.0 INTRODUCTION

This Quality Assurance Plan (QAP) has been prepared on behalf of Georgia-Pacific Corporation by Acton • Mickelson • Environmental, Inc (AME). The purpose of the QAP is to:

- Describe the quality assurance/quality control (QA/QC) procedures the project team will follow during concrete, soil, sediment, surface water, and ground water sampling

- Provide for collection and reporting of data that are representative of field conditions, and are legally defensible.

This QAP reflects the selection of Curtis & Tompkins, Ltd. (C&T), Berkeley, California for routine analyses of concrete, soil, sediment, surface water, and ground water samples. North Coast Laboratories, Ltd. (NCL) of Arcata, California will perform analysis for pesticides and other individual compounds that require chemical-specific methods. Alta Analytical Laboratory, Inc. (Alta) of El Dorado Hills, California will conduct analyses for dioxins and furans.

2.0 PROJECT ORGANIZATION

Personnel assigned to the project will be required to familiarize themselves with pertinent protocols and procedures presented in the QAP. Sampling protocols are presented in the Sampling and Analysis Plan (SAP, Appendix A). Experienced staff will oversee and review all procedures related to data collection and analysis. The Project Organizational Chart is included as Figure C-1.

Project organization is summarized below.

2.1 Project Manager

The Project Manager is responsible for scope, cost, and technical considerations related to the project, staff and project coordination, and overall project-quality review implementation, and related to data collection, completeness, and presentation.

2.2 Project QA Officer

The Project QA Officer is responsible for reviewing the project's field and laboratory data collection and completeness QA program, including the training of personnel to follow established protocols and procedures. The Project QA Officer also monitors the maintenance and use of equipment necessary to conduct site fieldwork.

2.3 Site Health and Safety Officer

The Site Health and Safety Officer is responsible for developing, implementing, and updating the site health and safety plan to be consistent with foreseeable conditions that may be encountered during field operations.

2.4 Project Staff

Project Staff and Field Team Leaders will assist the Project Manager in technical implementation of project tasks, field measurements, and sampling as required. AME will utilize in-house technical staff, who will report to the Project Manager.

3.0 QUALITY ASSURANCE OBJECTIVES

Data quality objectives (DQOs) (Table C-1) are quantitative and qualitative statements that specify the environmental-data quality required to support decision-making. DQOs define the total acceptable data uncertainty, including sampling- and analytical-instrument error, for each specific sampling-event activity.

To achieve DQOs, specific data quality requirements such as detection limits, criteria for accuracy and precision, sample representativeness, data comparability, and data completeness will be specified. Overall project objectives and requirements have been established to allow for a high degree of confidence in the data obtained.

Ground water and soil samples will be collected to qualitatively and quantitatively define an array of select organic constituents.

3.1 Precision, Accuracy, Representativeness, Comparability, and Completeness—Definitions and Equations

Data quality and quantity are measured using established acceptable limits for data precision, accuracy, representativeness, comparability, and completeness (PARCC) as described in *Data Quality Objectives for Remedial Response Activities* (United States Environmental Protection Agency [EPA] document EPA/540/G-87/003).

3.1.1 Precision

Precision measures condition-specific data or measurement reproducibility and is stated in terms of relative percent difference (RPD) or relative standard deviation (RSD). RPD and RSD equations are:

$$RPD = \frac{(D1 - D2)}{(D1 + D2)/2} * 100$$

Where:

D1 and D2 = the two replicate values

$$RSD = \frac{S}{\bar{x}}; \text{ and } S = [n (x_i - \bar{x})^2/n-1]^{1/2}$$

Where:

S	=	standard deviation
x_i	=	each observed value
i	=	number of observations
$\bar{x}$	=	the arithmetic mean of all observed values
n	=	total number of values

The accuracy and precision DQO for lab blank, trip blank, and field blank samples is less than the quantitation limit for each target compound. Accuracy and precision DQOs for matrix spike recovery, matrix spike duplicate, and laboratory control sample recovery are presented with the C&T Quality Assurance Manual (C&T QAM, Appendix C-1), the NCL QAM (Appendix C-2), and the Alta Quality Manual (Alta QM, Appendix C-3), collectively referred to herein as the laboratory QAMs.

3.1.2 Accuracy

Accuracy measures measurement-system bias that may result from sampling or analytical error. Field and trip blanks, as well as matrix spike QC samples and Laboratory Control Samples (LCSs), will be used to measure accuracy for project samples. The accuracy equation is:

$$\%R = \frac{SSR - SR}{SA} = 100$$

Where:

%R	=	% recovery
SSR	=	spike sample result
SR	=	sample result
SA	=	amount of spike added to sample

The accuracy and precision DQO for lab blank, trip blank, and field blank samples is less than the quantitation limit for each target compound. Accuracy and precision DQOs for matrix spike recovery, matrix spike duplicate, and laboratory control sample recovery are presented within the laboratory QAMs (Appendix C-1 to C-3).

3.1.3 Representativeness

Representativeness expresses the degree to which sample data represent the characteristics of the media or matrix from which they are collected. Representativeness will be measured by using the methods (e.g., sampling, handling, and preserving) in accordance with the project-specific standard operating procedures (SOPs) and the documents listed below.

- EPA. 1986. *National Environmental Investigation Center Policies and Procedures Manual*. EPA 330/978-001R. May.

- EPA. 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (3rd ed. and updates)*. SW-846. November.

Representativeness will also be measured by the collection of field duplicates or replicates (e.g., volatile organics). Comparison of the analytical results from field duplicates or replicates will provide a direct measure of individual sample representativeness.

3.1.4 Comparability

Comparability expresses the confidence with which one data set can be compared with another data set from a different phase or from a different program. Comparability involves a composite of the above parameters as well as design factors such as sampling and analytical protocols. An acceptable level of comparability will be accomplished through the consistent use of accepted analytical and sampling methods.

3.1.5 Completeness

Completeness is defined as the percentage of data that is judged to be valid to achieve investigation objectives compared to the total amount of data. The equation used for completeness is presented below:

$$C\ (\%) = \frac{D}{P \times n} \times 100$$

Where:

D	=	number of confident quantifications
P	=	number of analytical parameters per sample requested for analysis
n	=	number of samples requested for analysis

3.2 Procedures For Monitoring PARCC Parameters

Precision, accuracy, representativeness, comparability and completeness parameters will be monitored through the submission and analyses of many types of field and laboratory QC samples. These will include appropriate field blanks, trip blanks, laboratory method blanks, field and laboratory duplicates or replicates, matrix spikes, LCSs, calibration and check standards.

LCSs are samples containing a known or true value, which the laboratory prepares and analyzes concurrently with project samples. LCSs are most useful in judging analytical accuracy.

The frequency by which the field QC samples will be prepared and submitted is specified in Table C-2. Matrix spike and LCS quality control limits are specified following the laboratory QAMs (Appendix C-1 to C-3).

4.0 SAMPLING METHODS

Representative field and laboratory data will be obtained through the use of consistent sample collection, sample preservation, and sample handling methods, which are described in the SAP (Appendix A).

5.0 SAMPLE COLLECTION AND SAMPLE CUSTODY PROCEDURES

The protocols that field personnel will follow while collecting soil and ground water samples during routine sampling activities are presented in the SAP (Appendix A). A Laboratory Sample Receipt Checklist is presented as Table C-3. Departures from the protocols must be approved by the Project Manager prior to implementation and documented in the field notebook.

6.0 FIELD AND LABORATORY QC REQUIREMENTS

The QC procedures to be followed in the field and laboratory are described below.

6.1 Field Procedures

Quantitative field data (i.e., pH, specific conductance, turbidity, dissolved oxygen, and water temperature) will be obtained during ground water quality monitoring. Protocols presented in the SAP (Appendix A) describe the instruments used to measure water quality parameters and the calibration methods, standards, and frequency requirements for each instrument. Manufacturer instructions are followed for calibration, standard selection, and frequency requirements for the field instruments. Water levels will be measured with an electronic sounder that requires no calibration.

6.2 Laboratory Procedures

Calibration procedures and frequency of calibration for laboratory instruments are described in the laboratory QAMs (Appendix C-1 to C-3). In general, samples will be processed as a batch (i.e., without interruptions from samples from other projects). Samples will be processed sequentially and samples to be analyzed by a given method will be generally processed on the same apparatus.

7.0 LABORATORY QUALIFICATIONS

Soil and ground water samples will be analyzed by laboratories certified by the California Department of Health Services pursuant to the provisions of the California Environmental Laboratory Improvement Act of 1988 (Health and Safety Code, Division 1, Part 2, Chapter 7.5, commencing with Section 100825).

8.0 DATA ASSESSMENT AND MANAGEMENT

The methods for assessing and handling field and laboratory data are discussed below.

8.1 Data Assessment

Data generated during the soil and ground water assessment and monitoring programs will be evaluated for completeness (i.e., the amount of data meeting project QA/QC goals). If data generated during the field operations or by analytical procedures appear to deviate significantly from observed trends, the Project Manager and/or QA Officer will review field or laboratory procedures with the appropriate personnel to evaluate the cause of such deviations. Where data anomalies cannot be explained, resampling may be necessary. DQOs are summarized in Table C-1.

8.2 Management of Field Data

Field personnel are responsible for monitoring the collection and reporting of field data. Field personnel will also review field measurements at the time of measurement and will re-measure parameters as necessary.

As they are collected, field data will be recorded on field data sheets and maintained in a project file. Upon delivery to the office, appropriate field data will be entered into the project database to expedite the validation and interpretation process. The Project Manager, Project QA Officer, or appropriate field personnel will review field procedures and compare field data to previous measurements.

8.3 Management of Laboratory Data

Results of laboratory analyses will be reported as specified in the laboratory QAMs (Appendix C-1 to C-3). Analytical results will be reported in units of final use. Laboratory calculations will be performed as prescribed for a given analytical method or in conformance with acceptable laboratory standards at the time the calculation is performed. Each laboratory will retain QA/QC records for at least 5 years. Copies of raw data and supporting data validation information will be available for review at the laboratory and may also be requested as part of QA/QC review. Original laboratory reports will be stored in the project files. The laboratory will provide the data in hard copy and electronic format. Laboratory data will be entered into the project database to expedite data reduction, interpretation, and reporting.

9.0 ANALYTICAL METHODS AND QC REQUIREMENTS

The analytical methods to be followed and the QC requirements are discussed in the following sections.

9.1 Analytical Methods

The laboratory QA program plans for surface water, ground water, soil, and concrete samples are presented in the Laboratory QAMs (Appendix C-1 to C-3). Surface water, ground water, soil, and concrete samples will be analyzed by one or more of the following test methods:

- Total petroleum hydrocarbons as gasoline (EPA Method 8015 Modified)
- Total petroleum hydrocarbons as diesel and motor oil with silica gel cleanup (EPA Method 8015 Modified)
- VOCs (EPA Method 8260)
- VOCs (EPA Method 8260 with sample collection by EPA Method 5035)
- Semi-VOCs (SVOCs) (EPA Method 8270)
- Polynuclear aromatic hydrocarbons (EPA Method 8270 or 8310)
- Polychlorinated biphenyls (EPA Method 8082)
- Dioxins and furans (EPA Method 8290)
- Site-specific pesticides/herbicides (various EPA and in-house methods)
- California Title 22 Metals (EPA 6010/7400)
- Hexavalent chromium (EPA Method 7196)
- Cyanide (EPA Method 9010B or 335.4)
- Didecyldimethylammonium chloride (North Coast Laboratories in-house method)
- Nitrate, as nitrogen (EPA Method 300.0)
- Nitroglycerine (EPA Method 8332)
- Phenol, tetrachlorophenol, and pentachlorophenol (EPA Method 8270)
- Pentachlorophenol (water only, EPA Method 515.1)

- Nitrilotriacetic acid (special method)

In addition to the chemical analyses, selected soil samples may by analyzed for physical parameters by the following ASTM methods or equivalent:

- Dry bulk density (ASTM D2937)
- Moisture content (ASTM D2937)
- Total porosity (ASTM D854 and D2937)
- Total organic carbon (ASTM D2974)

9.2 Quality Control Requirements

The goals for assessing precision and accuracy of laboratory measurements are consistent with those put forth in the descriptions contained in Test Methods for Evaluating Solid Waste Physical/Chemical Methods SW-846. Chemical constituent practical quantitation limits are presented in Appendix C-1. Table C-4 presents the requirements for containers, preservation techniques, and holding times for soil and aqueous samples.

To evaluate the precision and accuracy of analytical data, QC samples will be analyzed periodically for this project. The minimum project requirements for collection and analysis of these samples are listed in Table C-2.

10.0 DATA REVIEW AND VERIFICATION

The Project QA Officer or Project Manager will review laboratory data. Table C-5 outlines the procedures for data verification. If comparison of data to previous measurements or known conditions at the site indicates anomalies, the laboratory will be instructed to review the submitted data while the Project Manager reviews the methods used to collect and handle the samples. If anomalies remain, the laboratory may be asked to re-analyze selected samples; other possible corrective actions are discussed in Section 10.3 below.

10.1 Performance and System Audits

The Project QA Officer or Project Manager will audit field and analytical activities throughout the project. The audit program consists of:

- Observing field activities to confirm that procedures are performed in accordance with project protocols and standard accepted methods, as detailed in the protocols in the SAP (Appendix A).

- Reviewing Daily Field Records, Monitoring Well Sampling Records, and any other data collection sheets during and after field measurements.

- Reviewing laboratory analytical data.

10.2 Preventive Maintenance

Each piece of field equipment will be checked before field activities begin and according to its routine maintenance schedule. Spare parts, including batteries, pH and conductivity meter probes, and other items required for collecting field data will be stored with field equipment to reduce field downtime. The appropriate field personnel will report equipment maintenance and/or replacement needs to the Project Manager or QA Officer and record the information on the Daily Field Record. The laboratory is required to perform preventive maintenance as prescribed in its laboratory QA manual.

10.3 Corrective Actions

Corrective actions may be initiated if the data quality objectives are not achieved. The initial step in corrective action will be to instruct the analytical laboratory to examine its procedures to assess whether analytical or computational errors caused the anomalous results. At the same time, sample collection and handling procedures will be reviewed to assess whether they could have contributed to the anomalous results. Based on this evaluation, the Project Manager, with the Project QA Officer, will assess whether re-analysis or re-sampling is required or whether any protocol should be modified for future sampling events. Laboratory corrective actions are described in the laboratory QA manuals. Any changes in laboratory methods, reporting limits, or QA parameters or limits require written approval by the Project Manager prior to implementation by the laboratory. A copy of the Corrective Action Form is provided in Appendix C-2.

10.4 QA Reporting

Reports that describe soil and ground water sampling activities and results will contain an evaluation of the quality of the data obtained and the laboratory's QA/QC report. These reports will be prepared by the Project QA Officer and reviewed by the Project Manager. Unless otherwise specified, the laboratory will retain raw data and QA documentation for chemical analyses for at least 6 years after generation. Significant QA issues will be reported and discussed in the corresponding technical report.

11.0 REMARKS

This plan represents our professional opinions, which are based in part on information supplied by the client. These opinions are based on currently available information and have been arrived at in accordance with currently accepted hydrogeologic and engineering practices at this time and location. Other than this no warranty is implied or intended. Any reliance on the information contained herein by third parties is at such parties' sole risk.

TABLE C-1

DATA QUALITY OBJECTIVES

Georgia-Pacific Corporation California Wood Products Manufacturing Facility

90 West Redwood Avenue, Fort Bragg, California

DQO Parameter	Aqueous Criteria	Soil/Solid Criteria
Precision	Appendix C-1	Appendix C-1
Accuracy	Appendix C-1	Appendix C-1
Sensitivity	Appendix C-1	Appendix C-1
Representativeness (Field Duplicates)	The RPD between the results of aqueous field duplicates should be less than or equal to 30 percent for results greater than 5 times the QL. The difference between results in aqueous field duplicates should be less than the QL when at least one result is less than or equal to 5 times the QL.	The RPD between the results of soil/solid field duplicates should be less than or equal to 50 percent for results greater than 5 times the QL. The difference between results in soil/solid field duplicates should be less than 2 times the QL when at least one result is less than or equal to 5 times the QL.
Completeness	90 percent	90 percent
Comparability	Based on Precision and Accuracy and Media Comparison	Based on Precision and Accuracy and Media Comparison

Notes

QL = quantitation limit

DQO = data quality objective

RPD = relative percent difference

TABLE C-2

SUMMARY OF DATA QUALITY INDICATORS FOR FIELD PROCEDURES AND CONDITIONS
Georgia-Pacific Corporation California Wood Products Manufacturing Facility
90 West Redwood Avenue, Fort Bragg, California

QC Element	Frequency	Acceptance Criteria	Corrective Action
Equipment Blank	One per day per non-dedicated water sampling device used.	< RL for each compound	Investigate and document the source of contamination. Use correct sampling and handling protocols, as well as professional judgement, to determine if resampling is necessary for affected samples.
Trip Blank	One per VOC cooler storing aqueous samples.	< RL for each compound	Investigate and document the source of contamination. Use correct sampling and handling protocols, as well as professional judgement, to determine if resampling is necessary for affected samples.
Bottle Blank	One per lot of sample bottles. Analyze if contamination is detected in EB.	< RL for each compound	Investigate and document the source of contamination. Use correct sampling and handling protocols, as well as professional judgement, to determine if resampling is necessary for affected samples.
Field Duplicate	One per 10 samples; minimum of 1 per sample matrix.	Water Sample: ≤ 30% RPD [(a)] Soil Sample: ≤ 50% RPD	Investigate and document source of variability. Use correct sampling and analytical protocols unless a matrix effect is indicated. If a matrix effect is not indicated, use professional judgement to determine if resampling is necessary for affected samples.
Review of field notes/boring logs, chain of custody documentation, and laboratory sample receipt documentation	NA	Professional Judgment	Investigate, document, and correct sampling and handling protocols, as appropriate. Use professional judgement to determine if resampling is necessary for affected samples.

Notes

a. $$RPD = 100 \times \frac{x_1 - x_2}{(x_1 + x_2)/2}$$

"<" = less than
"≤" = less than or equal to
RPD = relative percent difference
RL = reporting limit
VOC = volatile organic compound
NA = not applicable

TABLE C-3

LABORATORY SAMPLE RECEIPT CHECKLIST
Georgia-Pacific Corporation California Wood Products Manufacturing Facility
90 West Redwood Avenue, Fort Bragg, California

Laboratory: _____ Login No.: _____

Consultant: _____ Project: _____

Date Received: _____ Number of Coolers: _____

1. If samples were shipped, were they received with the proper shipping documentation (airbill)?	☐ Yes	☐ No
2. Were custody seals on outside of transport cooler(s)?	☐ Yes	☐ No
3. Were custody seals on transport cooler(s) intact upon arrival?	☐ Yes	☐ No
4. Were custody papers dry and intact upon arrival?	☐ Yes	☐ No
5. Were custody papers filled out properly?	☐ Yes	☐ No
6. Was sufficient ice used (if appl.)? Temperature: _____	☐ Yes	☐ No
7. Were all containers intact upon arrival? If no, list below	☐ Yes	☐ No
8. Were labels in good condition and complete (ID, date, signature, etc)?	☐ Yes	☐ No
9. Did labels agree with custody papers?	☐ Yes	☐ No
10. Were appropriate containers used for tests indicated? If no, list below.	☐ Yes	☐ No
11. Were samples correctly preserved? If no, list below.	☐ Yes	☐ No
12. Was sufficient sample received for tests indicated? If no, list below.	☐ Yes	☐ No
13. Were bubbles/headspace absent in VOA samples? If no, list below. Note: Soil sample headspace must be assessed at time of analysis.	☐ Yes	☐ No

Comments: _____

_____

_____

_____

Signature: _____ Date: _____

Title: _____

TABLE C-4

ORGANIC CHEMISTRY AND METALS PARAMETERS
Georgia-Pacific Corporation California Wood Products Manufacturing Facility
90 West Redwood Avenue, Fort Bragg, California

Parameter	Matrix	Prep Method	Analytical Method	Holding Time[e]	Minimum Volume	Water Sampling	
						Container	Preservative[g]
ORGANIC CHEMICALS							
Dioxins & Furans (low concentration)	Water	METHOD[d]	EPA 8290	30/45[f]	1 L	1L G	None[h]
	Soil	METHOD[d]	EPA 8290	30/45[f]	10 g		
Ethylene Glycol	Water	EPA 3520	EPA 8015B	14/	1 L	1L G	None
MTBE	Water	EPA 5030	EPA 8260B	14 d	40 mL	2 x 40 mL VOA	HCL[h]
	Soil	EPA 5030[i]	EPA 8260B	14 d	5 g		
Organochlorine Herbicides	Water	METHOD[d]	EPA 8151	7/40[f]	1 L	1L G	None
	Soil	METHOD[d]	EPA 8151	14/40[f]	30 g		
Organochlorine Pesticides	Water	EPA 3520	EPA 8081A	7/40[f]	1 L	1L G	None
	Soil	EPA 3550	EPA 8081A	14/40[f]	30 g		
Pentachlorophenol	Water	EPA 3520	EPA 515.1	14	1 L	1L G	None[h]
	Soil	EPA 3550	EPA 8270	14/40[f]	30 g		
Phenol	Water	EPA 3520	EPA 8270	7/40[f]	1 L	1L G	None[h]
	Soil	EPA 3550	EPA 8270	14/40[f]	30 g		
Resorcinol	Water	EPA 3520	EPA 8270	7/40[f]	1 L	1L G	None[h]
	Soil	EPA 3550	EPA 8270	14/40[f]	30 g		
Polychlorinated Biphenyls, Individual Cogeners	Water	EPA 3520	EPA 8082	7/40[f]	1 L	1L G	None
	Soil	EPA 3550	EPA 8082	14/40[f]	30 g		

TABLE C-4

ORGANIC CHEMISTRY AND METALS PARAMETERS
Georgia-Pacific Corporation California Wood Products Manufacturing Facility
90 West Redwood Avenue, Fort Bragg, California

Parameter	Matrix	Prep Method	Analytical Method	Holding Time[e]	Minimum Volume	Water Sampling	
						Container	Preservative[g]
Polynuclear Aromatic Hydrocarbons	Water	EPA 3520	EPA 8310	7/40[f]	1 L	1L G	None[h]
	Soil	EPA 3550	EPA 8270	14/40[f]	30 g		
Semivolatile Organics	Water	EPA 3520	EPA 8270	14/40[f]	1 L	1L G	None[h]
	Soil	EPA 3550	EPA 8270	14/40[f]	30 g		
Tetrachlorophenol	Water	EPA 3520	EPA 8270	14/40[f]	1 L	1L G	None[h]
	Soil	EPA 3550	EPA 8270	14/40[f]	30 g		
TPHd[c]	Water	EPA 3520/ EPA 3630 cleanup	EPA 8015B	14/40[f]	500 mL	1L G	None
	Soil	CA LUFT[d]/ EPA 3630 cleanup	EPA 8015B	14/40[f]	50 g		
TPHg[b]	Water	EPA 5030	EPA 8015B	14 d	40mL	2 x 40mL VOA	HCL[h]
	Soil	EPA 5035	EPA 8015B	14 d	5 g		
TPHo[c]	Water	EPA 3520/ EPA 3630 cleanup	EPA 8015B	14/40[f]	500 mL	1L G	None
	Soil	CA LUFT[d]/ EPA 3630 cleanup	EPA 8015B	14/40[f]	50 g		
Volatile Organics (8260 list)	Water	EPA 5030	EPA 8260	14 d	40 mL	2x40mL VOA	HCL[h]
	Soil	EPA 5035	EPA 8260	2 d	5 g		

TABLE C-4

ORGANIC CHEMISTRY AND METALS PARAMETERS
Georgia-Pacific Corporation California Wood Products Manufacturing Facility
90 West Redwood Avenue, Fort Bragg, California

Parameter	Matrix	Prep Method	Analytical Method	Holding Time[e]	Minimum Volume	Water Sampling	
						Container	Preservative[g]
Volatile Organics (8260 list, plus ethanol and isopropanol and/or MTBE)	Water	EPA 5030	EPA 8260	14 d	40 mL	2x40mL VOA	HCL[h]
	Soil	EOA 5035	EPA 8260	2 d	5 g		
METALS AND GENERAL CHEMISTRY							
CA Title 22 metals	Water	EPA 200.8 / METHOD[d]	EPA 6020 / 7400	6 mo / 28 d[d]	100 mL	500mL P	HNO_3
	Soil	EPA 3050B / METHOD[d]	EPA 6010B / 7400	6 mo / 28 d[d]	5 g		
		EPA 3050B / METHOD[d]	EPA 6020 / 7400	6 mo / 28 d[d]	5 g		
Cyanide	Water	None	EPA 335.2 or 9010B	14 d	500 mL	500mL P	NaOH
	Soil	None	EPA 9010B	14 d	5 g		
Hexavalent Chromium	Water	METHOD[d]	EPA 7199	24 hr	50 mL	250mL P	
	Soil	EPA 3060A	EPA 7196A	30 d	40 g		
Lead	Water	EPA 200.8	EPA 6020	6 mo	100 mL	250mL P	HNO_3
	Soil	EPA 3050B	EPA 6010B	6 mo	2 g		
Mercury	Water	METHOD[d]	EPA 7470A	28 d	100 mL	250mL P	HNO_3
	Soil	METHOD[d]	EPA 7471A	28 d	0.5 g		

TABLE C-4

ORGANIC CHEMISTRY AND METALS PARAMETERS
Georgia-Pacific Corporation California Wood Products Manufacturing Facility
90 West Redwood Avenue, Fort Bragg, California

Parameter	Matrix	Prep Method	Analytical Method	Holding Time[e]	Minimum Volume	Water Sampling	
						Container	Preservative[g]
Nitrate, as N	Water	-	EPA 300.0	48 hr	100 mL	250 mL	None

Source: Curtis & Tompkins, Ltd.
** = From source other than Curtis & Tompkins, Ltd.*

Notes
a. MTBE (methyl tert-butyl ether) may be added upon request.
b. JP-4, mineral spirits, or stoddard solvent may be added upon request. Reporting limits may be higher for fuels than other gasoline.
c. Motor oil, commercial jet fuel, JP-5, hydraulic oil, transformer oil, or Bunker C may be added upon request. Reporting limits may be higher for fuels other than diesel.
d. "Method" indicates that the prep method is an integral part of the CA LUFT analytical method.
e. Holding times specified in 40CFR 136.3 Table 2 (Clean Water Act/NPDES) and SW-846 Table 2-36 Revision 3, December 1996.
f. X/Y: X d from sample collection to extraction, then Y d from extraction to analysis.
g. Samples should be kept at 4°C from time of collection until analysis. Preserved containers can be supplied by C & T.
h. Free chlorine should be neutralized with 0.008-percent $Na_2S_2O_3$.
i. 28-day holding time for mercury; 6-month holding time for all other elements.

"<" = less than
">" = greater than
°C = degrees Celsius
BTXE = benzene, toluene, xylene, and ethylbenzene
C & T = Curtis & Tompkins, Ltd.
CA LUFT = California Department of Health Services Leaking Underground Fuel Tank Manual, October 1989.
CFR = Code of Federal Regulations
d = day(s)
EPA = United States Environmental Protection Agency
G = amber glass
g = gram(s)
GC/FPD = gas chromatograph / flame photometric detector
H_2SO_4 = sulfuric acid to pH < 2
HCL = hydrochloric acid to pH < 2
HNO_3 = nitric acid to pH < 2.
hr = hour(s)
JP-4 = mineral spirits
JP-5 = jet fuel
L = liter(s)
mg/kg = milligram(s) per kilogram
mg/L = milligram(s) per liter

TABLE C-4

ORGANIC CHEMISTRY AND METALS PARAMETERS
Georgia-Pacific Corporation California Wood Products Manufacturing Facility
90 West Redwood Avenue, Fort Bragg, California

Parameter	Matrix	Prep Method	Analytical Method	Holding Time[e]	Minimum Volume	Water Sampling	
						Container	Preservative[g]

mL = milliliter(s)
mo = month(s)
MTBE = methyl tert-butyl ether
$Na_2S_2O_3$ = sodium thiosulfate
NaOH = sodium hydroxide to pH > 12
NPDES = National Pollutant Discharge Elimination System
NS = no holding time specified
P = polyethylene
TPH = total petroleum hydrocarbon(s)
TPHd = total petroleum hydrocarbon as diesel
TPHg = total petroleum hydrocarbon as gasoline
TPHo = total petroleum hydrocarbon as motor oil
VOA = volatile organic analysis vial
VOC = volatile organic compound

TABLE C-5
SUMMARY OF DATA VERIFICATIONS PARAMETERS AND CRITERIA

Georgia-Pacific Corporation California Wood Products Manufacturing Facility
90 West Redwood Avenue, Fort Bragg, California

Data Verification Parameter		Means of Assessment	Acceptance Criteria	Verification Action
Preservation and Holding Times		Check chain of custody records, field records, and lab records.	See Tables C-3 and C-4	1. If improperly preserved, qualify as estimated (indicated by a "J" following the value in the data summary table) all positive detects (+) and reject (R) all nondetect (-) results. If aromatic compounds have not been properly chemically preserved, data is acceptable if analyzed within 7 days. 2. If holding times exceeded, but sample properly preserved, J all (+) and UJ all (-) results if analyzed in 28 days; if > 28 days, R all (-) results.
Lab Blanks	1. Method Blank	Check that blanks (sand used as method blanks for soil) were analyzed at the appropriate frequency (MB at one per batch of 20 or fewer samples; IB frequency is method specific); compare results to acceptance criteria.	< Reporting Limit (RL) for each compound	1. If result > 5 times blank, no action. 2. If result ≤ 5 times blank, but ≥ RL, report as undetected (U) at result level. 3. Use 10 times for common laboratory contaminants (e.g., acetone, methylene chloride, 2-butanone). 4. If gross contamination > 10 times RL exists, use professional judgement to determine if affected compounds in samples associated with that blank should be qualified R.
	2. Instrument Blank			
Surrogate Spikes		Check that all samples and blanks were properly spiked; compare results to acceptance criteria.	See Appendix C-1	1. If any percent recovery > acceptance criteria, J (+) results and accept (-) results. 2. If any percent recovery < acceptance criteria but ≥ 10 percent, J (+) results and UJ (-) results. 3. If any percent recovery < 10 percent, J (+) results and R (-) results.

TABLE C-5
SUMMARY OF DATA VERIFICATIONS PARAMETERS AND CRITERIA

Georgia-Pacific Corporation California Wood Products Manufacturing Facility
90 West Redwood Avenue, Fort Bragg, California

Data Verification Parameter	Means of Assessment	Acceptance Criteria	Verification Action
Matrix Spike/Matrix Spike Duplicate	Check that MS/MSDs were analyzed at a frequency of one per batch of 20 or fewer samples; compare results to acceptance criteria. If the percent recovery does not meet acceptance criteria, review other QC criteria (e.g. LCS results).	See Table C-2 and Appendix C-1	No action is taken on MS/MSD data alone. Use professional judgment in conjunction with other QC criteria to determine the need for qualification of the data. Evaluate whether the results of the MS/MSD effect only the sample spiked or all associated samples for one or more analytes, and qualify accordingly: 1. If any percent recovery > acceptance criteria, J (+) results and accept (-) results associated with the MS/MSD. 2. If any percent recovery < acceptance criteria but ≥ 10 percent, J (+) results and UJ (-) results associated with the MS/MSD. 3. If any percent recovery < 10 percent, J (+) results and R (-) results associated with the MS/MSD. 4. If RPD outside limits, J (+) results and UJ (-) results associated with the MS/MSD.
Laboratory Control Sample (LCS)	Check that LCSs were analyzed at a frequency of one per batch of 20 or fewer samples; compare results to acceptance criteria.	See Tables C-2 and C-3	1. If any percent recovery > acceptance criteria, J (+) results and accept (-) results associated with the LCS. 2. If any percent recovery < acceptance criteria but ≥ 10 percent, J (+) results and UJ (-) results associated with the LCS. 3. If any percent recovery < 10 percent, J (+) results and R (-) results associated with the LCS.

TABLE C-5
SUMMARY OF DATA VERIFICATIONS PARAMETERS AND CRITERIA

Georgia-Pacific Corporation California Wood Products Manufacturing Facility
90 West Redwood Avenue, Fort Bragg, California

Data Verification Parameter		Means of Assessment	Acceptance Criteria	Verification Action
Field Blanks: (Water)	1. Equip. Blank 2. Trip Blank 3. Bottle Blank	Check that aqueous sample blanks were analyzed at the appropriate frequency (Table C-2); compare results to acceptance criteria.	< RL for each compound	Water Sample: 1. If result > 5 times blank, no action. 2. If result ≤ 5 times blank, but ≥ RL, report associated samples as undetected (U) at result level. 3. If gross contamination > 10 times RL exists, use professional judgement to determine if affected compounds in samples associated with that blank should be qualified R.
Field Duplicates		Check that field duplicates were analyzed at the appropriate frequency (Table C-2); compare results to acceptance criteria.	Water Sample: ≤30 percent RPD [a]	Detection in Both Samples: 1. If results ≥ 5 times quantitation limit (QL) in both, and RPD > acceptance criteria, J the result in both samples. 2. If result < 5 times QL in one or both samples, and RPD > acceptance criteria, use professional judgment to accept (A) or qualify (J or UJ) results, taking into consideration the increased variability of data near QL. 3. If precision data for the field duplicate pair,

TABLE C-5
SUMMARY OF DATA VERIFICATIONS PARAMETERS AND CRITERIA

Georgia-Pacific Corporation California Wood Products Manufacturing Facility
90 West Redwood Avenue, Fort Bragg, California

Data Verification Parameter	Means of Assessment	Acceptance Criteria	Verification Action
		Soil Sample: ≤50 percent RPD	surrogate compound recoveries, and laboratory MS/MSD indicate an extremely heterogeneous matrix at the site or potential sampling error, professional judgment should be utilized to apply field duplicate actions to all samples of the same matrix. <u>Detection in Only One Sample:</u> 1. Do not evaluate based on RPDs. 2. If result of (+) result ≥ 2 times QL for water and ≥ 3 times QL for soil and soil vapor, qualify (J or UJ) results in both samples.
		Vapor Sample: ≤50 percent RPD	3. If result of (+) result < 2 times QL for water and < 3 times QL for soil and soil vapor, use professional judgment to accept (A) or qualify (J or UJ) results, taking into consideration the increased variability of data near QL. 4. If precision data for the field duplicate pair, surrogate compound recoveries, and laboratory MS/MSD indicate an extremely heterogeneous matrix at the site or potential sampling error, professional judgment should be utilized to apply field duplicate actions to all samples of the same matrix.

TABLE C-5
SUMMARY OF DATA VERIFICATIONS PARAMETERS AND CRITERIA

Georgia-Pacific Corporation California Wood Products Manufacturing Facility
90 West Redwood Avenue, Fort Bragg, California

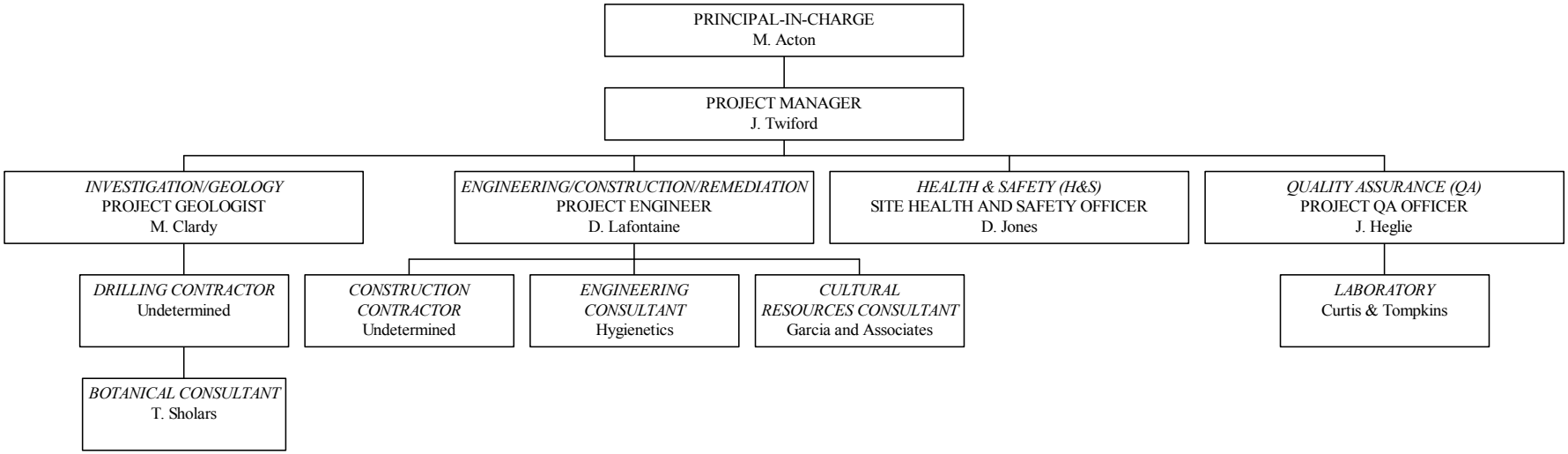
Data Verification Parameter	Means of Assessment	Acceptance Criteria	Verification Action
Review of field notes/boring logs, chain of custody documentation, and laboratory sample receipt documentation	NA	Professional Judgment	1. Accept (A), qualify (J), or reject (R) results, as appropriate. 2. Examples of situations where qualification or rejection of results should be considered include, but are not limited to: volatile analysis of coarse-grained materials, compromised sample containers, sample headspace, etc.

Notes

a. $RPD = 100 \times \frac{x_1 - x_2}{(x_1 + x_2)/2}$

"<" = less than
"≤" = less than or equal to
">" = greater than
"≥" = greater than or equal to
IB = Instrument Blank
LCS = Laboratory Control Sample
MB= Method Blank
MS/MSD = matrix spike/matrix spike duplicate
NA = not applicable
RPD = relative percent difference

FIGURE C-1
PROJECT ORGANIZATIONAL CHART



APPENDIX C-1

QUALITY ASSURANCE MANUAL-CURTIS & TOMPKINS

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (510) 486-0900

Laboratory Quality Assurance Manual

Version 7.4
Effective: 06-December-2004

This manual details the policies, practices, and procedures for ensuring that the quality of laboratory measurement data generated by Curtis & Tompkins Ltd., located at 2323 Fifth Street in Berkeley CA, meets the requirements of the National Environmental Laboratory Accreditation Program (NELAP).

 If this page does not bear a blue letterhead logo, original signatures in blue ink below, and a serial number indicating the copy number and number of copies printed in this revision, you do not possess a controlled copy of the document. This document expires one year from the date above but may be superceded by a new revision at any time. Please contact the laboratory at (510)-486-0900 if there is a need to verify the status of this revision.

Dr. Bruce Godfrey, President & Lab Director — Date 12/03/04

Teresa Morrison, QA Director — Date 12/01/04

John Goyette, Operations Manager — Date 12/1/04

Copy Number: 1 of 1 Printed Copies

C&T QA Manual

Table of Contents

1.0 INTRODUCTION QA POLICY

This document is Curtis & Tompkins' Quality Assurance Manual, which describes the laboratory procedures, practices, and philosophies that ensure data quality and reliability. The equally important aspect of client service quality is implicit in the text, but not explicitly stated here in terms of practices and procedures. We can only exist at the pleasure of our clientele. Satisfying their requirements for timeliness and professionalism, in every aspect of their interaction with our organization, is an essential part of our existence.

We at C&T are committed to a process of continuous quality improvement through employee participation. As a client-driven organization, we strive to provide a high quality product at a reasonable price. C&T's policy is to generate chemical measurement data of known quality as defined by adherence to specifications for accuracy and precision. The laboratory produces data that is both technically and legally defensible, for the intended use of our clientele. This manual outlines, for both clients and C&T employees, the measures taken to ensure and document data quality, monitor and assess quality activities, and the mechanisms that promote quality improvement.

The foundation of C&T's quality program is our employees, and their participation in developing and improving data quality and productivity while meeting client needs. C&T's organization is based on the concept of management participation in laboratory work and employee participation in management. Our employees are encouraged to participate on work teams formed throughout the laboratory in order to develop new products, resolve production or quality issues, and design and implement corrective actions, as required.

The following text outlines the core principles of our organization from which we have built a thriving business of more than 120 years duration.

1.1 Mission Statement

We are professionals in the chemical measurements business, for profit and the satisfaction of our clients and staff. We strive to exceed our clients' expectations while reporting results without bias. People are our greatest asset. We are committed to developing their capabilities in a challenging environment of personal and professional growth.

1.2 Basic Policies

We at Curtis & Tompkins conduct our activities in accordance with the Mission Statement above and:

1. We conform to all laws and statutes of the communities in which we do business, and act with integrity and social responsibility in dealing with our employees, clients, suppliers, and the public.

2. We provide employees with satisfying work, with performance judged objectively and reviewed at least once a year. We pay salaries equivalent to comparable market rates and promote from within wherever possible.

3. We expect a high ethical standard from our employees. We do not tolerate discrimination, sexism, or racism in any form or appearance.

4. We maintain a stringent safety program for the protection of our employees and the public.

5. We have established a professional management system with appropriate delegation, accountability, communication, and control.

6. We maintain written corporate policies and procedures for adherence by all employees.

1.3 Rules of the Game

High quality work begins with, and relies upon, good communication. Accordingly, C&T has developed and implemented the following rules for staff interaction to aid the quality improvement process. These rules are central to the success of the quality program.

1. Be willing to support our mission, vision, values, and policies.

2. Speak with good purpose. Listen actively and often.

3. Be open and honest in your communication with others.

4. Complete your Agreements. Be responsible to yourself and your coworkers.

    (a) Only make agreements you are willing and able to keep.
    (b) Clear up any broken or potentially broken agreements at the earliest appropriate time with the appropriate person.
    (c) Don't commit others unless you have their agreement.

5. If a problem arises, look first at the system, then at the people, then take corrective action.

6. If you can't help the customer, help someone who can.

7. Have the willingness to win, and allow others to win. Commit to win/win relationships.

8. Focus on what works. Discard that which does not work.

9. Bad news does not get better with time. Don't shoot the messenger.

10. "Raise the flag" to seek help when you are overloaded, and offer help to others whenever you are able to.

11. Maintain a sense of humor.

12. Innovation is good. Risk it.

13. Be "proactive". Generally, it's better to ask forgiveness, than to seek permission.

1.4 Policy on Ethics and Data Quality

Without a solid ethical foundation, C&T will fail. C&T expects its employees to be honest, and to know the difference between what is right and wrong. C&T expects its employees at all levels to adhere to a consistently high ethical standard. At C&T we don't lie, cheat, steal or deceive each other, our customers, suppliers or anyone else. Frequent honest and open communication is expected at all levels of the organization. C&T strives to actively recruit, select, and promote employees who espouse these values, and terminate the employment relationships with those who do not.

The purpose of this section is to describe C&T's policy regarding ethics and data quality, and to document the steps which must be taken when the quality of data is suspected or known to have been compromised by a deliberate act, error or omission. It addresses the code of ethical conduct expected of all C&T employees, and applies at every level in the organization.

C&T expects its employees to conform to all laws and statutes in the locations where we do business, and to act with integrity and social responsibility in dealing with fellow employees, clients, suppliers and the public. We expect our employees to disclose and correct situations where C&T does not act in this manner.

Accordingly:

- C&T is committed to integrity in the workplace.
- C&T's commitment to excellence in data quality extends to, and includes all aspects of data production analysis, review and reporting.
- Any attempt by management or by any employee to compromise this commitment presents a serious case for disciplinary action.
- All C&T employees will immediately report to management any information concerning the possible or factual falsification or misrepresentation of data or any associated components. Falsification or misrepresentation of data includes (but is not limited to) the following:

    1. Intentionally altering an instrument, computer, or clock to falsify time records.
    2. Altering the content of a logbook or data sheet with the intent to misrepresent.
    3. Falsifying or misrepresenting the identity of an analyst(s).
    4. Changing raw data documentation with the intent to obliterate or eliminate data;
    5. Preparation or submittal of false or "faked" data packages or any components of data packages;
    6. Use of illegal measurement techniques, such as peak shaving or fraudulent data system settings for the purpose of bypassing QC procedures;
    7. Deliberately modifying/manipulating computer programs, spreadsheets, or other automatic data reduction tools for the purpose of bypassing QC or to misrepresent the data;
    8. Any attempt to falsify or misrepresent data or events as they actually occur in the course of data production review and reporting;

It is the responsibility of all C&T employees to report any situation that may impact the final quality of the data. All C&T employees have the obligation to discuss known or suspected violations of this policy with management, including the Group Leaders, Department Managers, QA Director, and Lab Director. C&T hereby affirms that all employees are entitled to report such third party activity without fear of censure or reprisal.

When an employee has a question on data quality, he or she should first discuss the matter with the Group Leader or Department Manager who is closest to the situation and who can be relied upon to supply the answers.

If the discussion with the Group Leader, Department Manager, or QC Chemist fails to resolve the situation, the employee should meet with the QA Director, Operations Manager or Lab Director. If the data quality question involves the Group Leader, Department Manager, QC Chemist, Operations Manager, or other managers, the employee should discuss the matter directly with the QA Director or Lab Director. The substance of the discussion and any resolutions should be documented in writing.

If a satisfactory resolution is not obtained, or if it is not possible at the level in which the situation is being reviewed, then the issue must be brought immediately to the QA Director and/or the President. It is the responsibility of the QA Director to promptly investigate all any reports of known or suspected violations of this policy. Management will respond in a timely manner to all employee concerns regarding data quality.

If an employee has a concern regarding a violation of the ethics and integrity policy:

1. Discuss the problem with the employees' immediate Group Leader or Department Manager.

2. If the issue involves a Group Leader or Department Manager, the matter should be discussed with the Quality Assurance Director.

3. The QA Director and Lab Director are responsible to resolve the problem within the scope of C&T's policies.

4. If the matter cannot be resolved at the QA Director's level, it should be brought to the attention of the President.

It is the responsibility of C&T to provide all employees with the facilities, equipment, and training to achieve the data quality objectives and ethical behavior goals stated in this policy.

It is the responsibility of C&T to provide our clients with documented and legally defensible data of known quality.

To reaffirm awareness of, and commitment to, the highest standards of data quality, excellence and integrity, each employee is to sign a statement of their "Commitment to Excellence in Data Quality". The original statement is maintained in the individual's personnel files. New employees are required to complete the statement at the conclusion of their orientation.

1.5 Confidentiality

The measurement data, reports, conclusions, and related information provided C&T to its clients or otherwise generated by C&T are always considered confidential. No third party has a right to obtain information from C&T pertaining to our clients activities or related information without 1) permission from the client, or 2) appropriate and relevant legal process (warrant or subpoena). Our employees may not provide any confidential information without an appropriate and valid reason, as outlined in C&T's SOP for Confidential Business Information.

1.6 Conflict of Interest

C&T recognizes that certain situations may generate conflict of interest between C&T and its client, and/or C&T and its employees. To minimize the risk of an appearance or actual conflict of interest, C&T will strive to identify relationships between itself and its clients, and its employees that may constitute a conflict. Specifically, C&T employees are not allowed to 1.) work for a direct competitor in any capacity, 2.) accept gifts, gratuities, or awards in excess of $100 valuation in a 12 month period from any client, supplier, or in excess of $200 valuation from all clients suppliers or agencies in a 12 month period, or 3.) work directly for a client of C&T in the same, or related capacities as work performed for C&T. The appearance of, or actual conflict, must be corrected by terminating either the client or the employment relationship with C&T.

C&T Commitment to Excellence in Data Quality
December 28, 1998

As a C&T employee, I have the right and responsibility to report any situation which may be adverse to quality or which may impact the final quality or integrity of data produced for our clients.

I will report immediately to management any information concerning the misrepresentation, or the possible misrepresentation, of analytical data (or any of its associated components). Examples include (but are not limited to): intentionally altering an instrument, computer or clock to falsify time records; altering the content of a logbook or data sheet with the intent to misrepresent; falsifying or misrepresenting the identity of an analyst(s); changing raw data documentation with the intent to obliterate or eliminate data; preparation or submittal of false or "faked" data packages or any components of data packages; use of illegal measurement techniques, such as peak shaving, and fraudulent data system settings for the purpose of bypassing QC procedures; deliberately modifying/manipulating computer programs, spreadsheets, or other automatic data reduction tools for the purpose of bypassing QC or to misrepresent the data; or any attempt to falsify or misrepresent data or events as they actually occur in the course of data production review and reporting.

I will not knowingly participate in any such activities, nor will I fail to report any such activities of which I become aware. I understand that if I knowingly participate in any such prohibited activity, I may be subjected to serious disciplinary action, up to and including termination for cause, as well as possible individual debarment against participating on contracts awarded by the Federal Government.

I will report any actual or suspected violations of this policy to management. I have read and understood the reporting procedures and ethics policy are described in detail in the Laboratory Quality Assurance Program and the C&T Employee Policy Manuals. I understand that I have both the right and obligation to discuss any violation, or potential violation, of the ethics policy with the Quality Assurance Director, the President, and/or the other channels of communication outlined in the policy.

_____
Print Name

_____ _____
Signature Date

F:\qc\qam_v7\ethics.doc

2.0 SCOPE AND PURPOSE OF THE QA PROGRAM

2.1 Content

Curtis & Tompkins, Ltd. (C&T) provides a broad range of analytical testing services to industry, public utilities, engineering firms, and other private and public sector clients. This Quality Assurance Manual (QAM) describes in detail the measures taken by C&T to ensure the reliability of the analytical data produced in the laboratory. Approved technical and procedural standards are a corner stone of our approach. C&T relies on, and requires, the participation of all employees in the quality program to meet our goal of providing clients with technically and legally defensible data.

This Quality Assurance Manual (QAM) describes our QA Program (QAP) and is one of many documents that are used by C&T to ensure quality work. This manual describes the program as it is implemented within the laboratory. The other documents and tools of C&T's quality assurance program include Standard Operating Procedures (SOPs, a tabulation more than seven volumes totaling hundreds of distinct procedures appears in Appendix_2), and client-submitted Quality Assurance Project Plans (QAPPs) and Sampling and Analysis Plans (SAPs).

At C&T, quality is defined as adherence to specifications. In the world of analytical chemistry, the QA Program is aimed specifically at procedures for control of common errors such as false negatives, false positives and misquantitations. Implementation of the QAP ensures appropriate, accurate and complete documentation of all events related to the measurement process including adherence to specifications for accuracy, precision, and completeness of the measurement data.

C&T has a policy of establishing quality specifications that encompass limits and acceptance criteria for calibration events, accuracy (spikes), precision (duplicates), control samples for false positives (blanks) for every measurement procedure employed in its laboratories. This manual does **not** contain quality control specifications for the various testing products that are offered by the laboratory. These specifications are contained in the standard operating procedures for each specific testing method. References to specific documents, including revision status, and date implemented containing these specifications (SOP's) appear in Appendix_2 of this manual.

2.2 Purpose

An established QA philosophy and program are essential for consistent production of valid data. The QA program ensures that all data generated, reviewed, and reported are produced and interpreted by trained, capable people following appropriate procedures.

Quality Control includes the specific checks and measurements within the QA framework, which are used to assess both the measurement system and the quality of the data, produced. The specific QC requirements for each analytical procedure can be found in the appropriate SOP, but the program guidelines are established in this manual. Project specific QC requirements are established using QAPPs and SAPs, and will not be addressed in this manual except to state that when these requirements are in conflict with C&T's quality

assurance program the client's requirements take precedence (if known prior to analysis of the samples).

This QAM establishes the standards that C&T adheres to and provides mechanisms to:

- Document the precision, accuracy, representativeness, comparability, and completeness of the analytical measurement systems and the data produced.
- Recognize deficiencies quickly and provide an efficient mechanism for correction.
- Monitor and control the management of data and to document its validity.

2.3 Objectives and Scope

The objectives and scope of the quality assurance program include:

- Scheduling of independent review and audit of all technical procedures.
- Coordination of QA and QC procedures that provide a documented, consistent level of quality for environmental measurements.
- Responsibility for documentation of all data generated, stored, and reported as technically valid and legally defensible.

3.0 ORGANIZATION AND RESPONSIBILITIES

3.1 Organization

Curtis and Tompkins, Ltd. consists of one laboratory located in Berkeley, California. The laboratory is organized to facilitate sample management, analytical performance and management, and data reporting and management. The laboratory is fully staffed, including a QA Director who reports directly to the President concerning quality issues. This ensures the autonomy of the quality function because responsibility for operational and profit loss performance is entirely separate, and belongs to the Operations Manager. The corporate structure appears as an organization chart in Figure 3.1.

3.2 Responsibilities and Authority

Quality Assurance is supported at the highest corporate level by C&T's President and Laboratory Director, who is also the sole stockholder in the corporation. Recognition and support of QA at this level is of paramount importance to ensuring its effectiveness.

Development and implementation of QA policy within the laboratory is delegated by the President to the QA Director. The following positions in C&T's organization have specific responsibilities for the implementation of the QA Plan at C&T: Quality Assurance Director, Quality Control Chemists, Department Managers, Group Leaders, Project Managers, Chemists and Analysts. The responsibilities of the 'Technical Director' outlined in the NELAP standard are divided among the Laboratory Director, Quality Assurance Director, and Operations Manager.

Lab Director is primarily responsible for the application and development of the Lab's resources to meet or exceed current and future client requirements. The Lab Director's responsibilities encompass the general business management of the laboratory, and all its resources, including equipment, facilities, and personnel. Other responsibilities include, but are not limited to:

- Implementing corporate programs and directives for Personnel management, Quality Assurance, Financial and Resource Management.
- Training and development of the staff into an efficient and effective team.
- Strategic and Operational Planning
- Business development and overall client service satisfaction
- LIMS planning and systems development

Temporary or long-term absence of key personnel

Employee leave, travel, training, illness, and client meetings are normal reasons for staff to be absent from the lab. The Laboratory Director is responsible for assignment of responsibilities to any individuals at the laboratory. The procedure for making these assignments is based on the situation and duration of the absence, with the exception of assignment of those tasks related to the Quality Assurance Director. In particular, the

authority to independently stop work in response to a quality problem must be documented, to provide the individual to whom the responsibility is assigned the necessary organizational authority to execute this authority. For this reason, responsibilities of the Lab Director shall be assigned to the Quality Assurance Director the in the absence of the Lab Director, and vice-versa. The reassignment of responsibility for any key personnel shall be documented by memo to the individuals personnel file maintained by the QA Director.

QA Director is responsible for proactively managing the consistent, incremental improvement of C&T's services. Responsibilities include the quality of management systems, as well as data/product quality systems at the laboratory.

The QA Director has dual "core" responsibilities. The QA Director is responsible for data quality control by insuring the "first time" production and compliant documentation of the chemical measurements at the laboratory. The QA Director is also responsible for designing and implementing improvements in managerial systems that improve data quality, and operational effectiveness and efficiency. Other responsibilities include, but are not limited to:

- developing, implementing, and reviewing QA policies,
- identifying, reporting, and coordinating the resolution of QA issues, including stop work authority in response to quality problems,
- conducting performance reviews and audits,
- documenting and reviewing personnel training,
- providing training to all personnel regarding QA and QC policies,
- implementing QC procedures, monitoring the QA/QC standards of performance, and monitoring validity of the data generated by the laboratory,
- promptly investigating any reports of known or suspected violations of the ethics and integrity policy.

The responsibilities of the Quality Assurance Director shall be delegated to the Laboratory Director in the absence of the Quality Assurance Director.

Operations Manager is responsible for the day-to-day operations of the laboratory. The Operations Manager's primary goal is insuring, through both managerial and direct effort, the timely & profitable production of chemical measurement services. Other responsibilities include, but are not limited to:

- assigning and clearly communicating operational priorities,
- allocating daily resources,
- supervising Project Managers and Department Managers,
- ensuring that sufficient number of qualified employees are employed to perform and supervise the laboratory's work,

- assisting in employee performance reviews and audits,
- overseeing subcontractors and implementing subcontracting procedures,
- estimating laboratory capacity and projections.

The responsibilities of the Operations Manager shall be delegated to the Department Manager of the Client Services group in the absence of the Operations Manager.

Information Systems Manager is responsible for equipping and maintaining a well trained and informed staff to meet the expectations of C&T's clients and its management, by efficiently and effectively acquiring and storing information in easily retrievable structures and systems. Other responsibilities include, but are not limited to:

- documenting LIMS utilities and programs,
- controlling LIMS security and access,
- validating software,
- developing & implementing systems to control data integrity,
- maintaining audit trails for data changes.

Department Managers at C&T equip and maintain a well trained and informed staff to meet the expectations of our clients by efficiently and profitably generating defensible data on time. The tasks specifically attributable to Department Managers in the implementation of the QA Program are specified below under each of their five defined core management responsibilities:

- Planning:
  Setting management goals & objectives
- Staffing:
  Training a staff of up to 15 analysts in key technical skills, e.g., instrument & software operations.
  Providing documentation of training efforts and PE/LCS sample analysis
  Providing performance feedback to employees on their QA responsibilities.
  Orienting staff to QA responsibilities & procedures within their group
- Organizing & Directing:
  Assigning staff to complete tasks and projects related to QA Plan implementation
- Controlling:
  Reviewing data for compliance & completeness, implementation of the peer review process within their group.
  Writing and updating SOP's, and ensuring that current SOP's are available to Chemists & Analysts in their group and at their workstations.

Ensuring the correct and complete implementation of the benchbook, run log, and maintenance log procedures.
Ensuring compliance with the calibration standards tracking and control procedures within their group
Initiating and completing corrective action procedures, as needed.

- Technical Functions:
  Ensuring the implementation of preventative maintenance procedures for instruments and equipment.

Generally, Department Managers are responsible for understanding, communicating specific requirements to chemists and analysts in their group, and ensuring compliance with QAPPs and specific aspects of C&T's QA Plan. They ensure that all data produced in their group complies with all C&T specifications for technically and legally defensible data.

Quality Control Chemists are senior level chemists with experience in the laboratory as an analyst, laboratory Project Manager, or consultant/ engineer project chemist. QC Chemists may be temporarily assigned by the QA Director to perform Department Manager functions in the event of short absences. QC Chemists are primarily responsible for the following tasks:

- Data Review: Performing data review to assure lab data meet SOP and project specific requirements and assuring adherence to lab documentation practices.

- QAPP Review: Review project plans against C&T capabilities during bidding process and after award of contract. Entering client- and project-specific information into the LIMS databases. Assist Project Managers with data validation questions.

Project Managers are responsible for the interface between clients and the laboratory. Accordingly, clear communication to all constituents, including clients, Department Managers, QA & Lab Directors, analysts and field technicians, is their most important responsibility.

- Clearly communicating client requirements specified in QAPPs and elsewhere to all affected individuals within the laboratory. Obtaining, by appropriate means, the required commitment of all relevant individuals to understand and agree to meet client requirements.

- Informing Lab and QA Directors of situations and issues, and recommending actions required to meet client needs and expectations.

- Reviewing data packages submitted by Department Managers for compliance to Client requirements and QAPP specifications.

- Communicating, in a clear and timely manner, the status of work to clients either verbally or through written reports such as case narrative or project management reports.

Group Leaders at C&T are analysts who have demonstrated the interest and ability to organize, schedule, and train other analysts in a specific analysis (i.e.: TPH-Diesel) or range

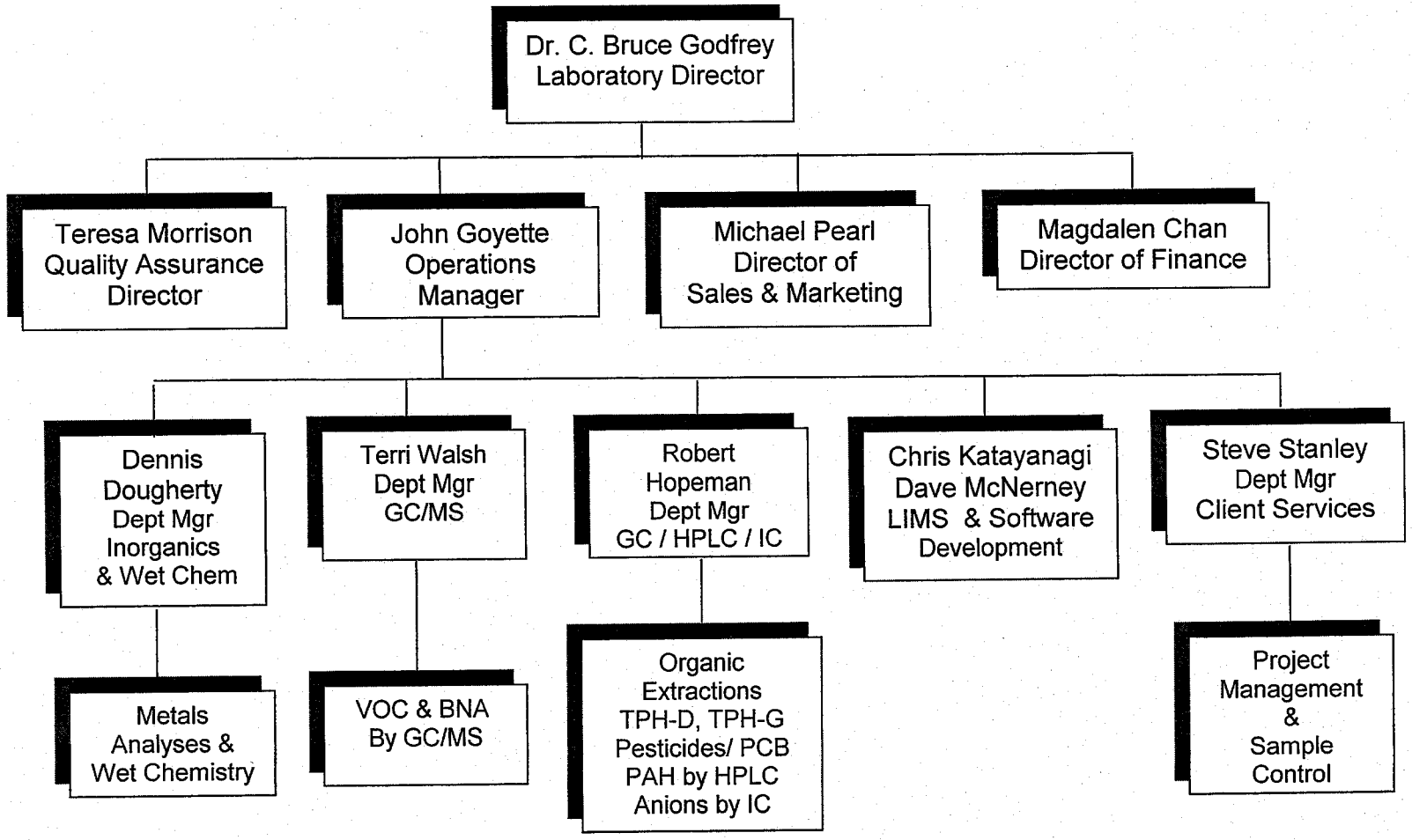
of related analyses (i.e.: wet chemistry analyses). They are responsible for assisting the Department Managers to which they are assigned improve the productivity and quality of the data produced by the department by:

- Scheduling and assigning daily tasks, and performing peer-level data review for compliance to established SOP and QC procedures and requirements,
- Assisting in training less experienced staff,
- Initiating and completing corrective action procedures, as needed.

Chemists and Analysts are responsible for understanding and applying QA and QC procedures in the areas in which they are assigned, and for seeking clarification as needed. C&T's QA Plan relies primarily on the ability of individuals performing analyses to do so in a manner that is technically and legally defensible. This demands attention to detail and a thorough understanding of the analytical process. Analysts receive formal orientation in the laboratory's QA Program within their first 90 days of employment. As part of this process the following responsibilities are clearly communicated:

- Clear, legible, and compliant entries into all benchbooks. Compliance with all procedures and specifications detailed in the SOP for Benchbooks entries.
- Clear, complete, and compliant documentation of all significant events in the measurement process is a requirement. Significant is meant as any step required to reconstruct the process after the fact, in order to detect an error or to demonstrate compliance to procedure.
- To obtain from Department Managers, Group Leaders or peers, a clear and complete understanding of QC compliance criteria for the tests and procedures they are performing.
- To inform Department Managers, Group Leader or peers of their understanding of any situation which is out of compliance with the QAP such that corrective action is initiated, if required.

Figure 3.1 **C&T Organization Chart**



Curtis & Tompkins, Ltd.

4.0 PERSONNEL QUALIFICATIONS & TRAINING

Technically and legally defensible data can only be produced by well-trained personnel who are adequately educated in their technical and managerial areas and in QA/QC procedures. Specific requirements for key personnel are outlined below.

4.1 Lab & QA Directors, and Operations Managers Qualifications

The minimum qualification for QA Directors, Laboratory Directors, and Operations Managers are:

- A bachelor's degree and three years of experience in a related field, or a master's degree and one year of related experience (three additional years of experience can substitute for the bachelor's degree).
- Proven communication skills.
- Proven management skills.
- Knowledge of the laboratory's technical and business regulations.
- Laboratory Directors must have three years of experience directly related to laboratory management.

4.2 Department Manager & QC Chemist Qualifications

Department Managers & QC Chemists must have the following minimum qualifications:

- A bachelor's degree and three years experience directly related to the activity they are supervising.
- One year of managerial/supervisory experience or two years of active participation within the existing group.
- Strong communications skills.
- Knowledge of applicable methodologies and systems under which the group routinely operates.
- Technical skills in computers and/or instrumentation relevant to the department they are supervising.

4.3 Analyst, Chemist, Group Leader, and Project Manager Qualifications

Analysts, chemists, Group Leaders, and Project Managers will range in experience from entry to senior level. We seek entry-level employees for chemist and analyst positions and then train them according to procedures and practices outlined in later sections of this chapter. We seek entry-level chemists and analysts with the following skills and background:

- A bachelor's degree in chemistry or a related discipline.
- Strong communications skills (particularly about technical issues).
- Strong commitment to quality and teamwork.

4.4 Classroom Training

The quality of our results, responsiveness to customers, and production efficiency throughout the organization depends on the competency of our staff. We address the C&T

mission statement "for the professional satisfaction of our staff" by committing resources toward the training and development of our people.

C&T has developed a training program that outlines curricula and processes for formal training classes in the following areas:

- New employee orientation
- Ethics and Integrity
- QA/QC Training
  Fundamentals 1: Intro to QA Program
  Fundamentals 2: Batch QC
  Fundamentals 3: Calibration
  Benchbooks, Logbooks and Documentation
  Computer chromatographic integration procedures
- General methods and specific analytical procedures
- Performance Management
- Communication Skills
- LIMS System
- Laboratory Health & Safety

The training files identify specific resources, course content, and outside workshops and meetings which have been approved for use in the development of our staff.

Periodic training is conducted to ensure that all employees maintain knowledge of current issues and practices in the laboratories. Selected personnel participate in managerial, QA/QC training or technical seminars, workshops, and professional organizations.

4.5 Functional Skills Training

In addition to the classroom type of training outlined above, C&T has developed a workstation approach to laboratory skills training. Each group in the laboratory is broken down into workstations, which typically comprise one analysis (for example PAHs by EPA 8310), but may comprise many test methods (for example wet chemistry workstations). Workstation skills criteria have been developed, with training and performance milestones. Typically Department Managers are responsible for providing training, however, in many instances Group Leaders and peers provide training at each workstation. Performance criteria to demonstrate chemists' competence to perform analyses at each workstation have been or are being developed. These criteria include an initial demonstration of proficiency consisting of the successful analysis of four consecutive laboratory control samples. Ongoing proficiency is demonstrated by annual analysis of a performance evaluation sample, a method detection limit study, or repetition of 4 consecutive laboratory control samples.

4.6 Other Training

We at C&T are committed to providing the necessary training to ensure that our employees are abreast of changes in technology, QA procedures, and relevant environmental regulations. "Right to Know" and Hazardous Communication Programs are administered under the Safety Program and field personnel are required to complete all appropriate training (for example, OSHA 40-hour Hazardous Operations Certification).

4.7 Training Records

The QA Director has a responsibility to ensure the lab staff takes advantage of C&T's training resources and programs, and to maintain records of each individual's training. Individual training records document classroom training events, method proficiency demonstrations (PE/LCS Sample results), trainer, date of training and any other required or additional training.

5.0 FACILITIES, EQUIPMENT, AND SUPPLIES

5.1 Laboratory Design

Curtis and Tompkins' laboratory was designed for safety and to prevent contamination of samples, and is fully equipped to perform a wide variety of environmental analyses. The use of appropriate, well-maintained facilities, equipment and supplies is fundamental to the production of high quality data.

5.2 Facilities

Curtis and Tompkins maintains a 23,500 square foot laboratory. Figure 5.1 presents a floor plan of the facility.

It is C&T's policy to maintain reasonable and strict security at its facility. C&T maintains security of proprietary information by implementing access control procedures designed to insure that only authorized individuals have access to:

- samples in storage, preparation, and analysis,
- all computer systems,
- data files and paper files containing results of sample & control analyses,
- confidential and proprietary information, and
- maintenance of audit trails for data changes in manual and automated systems

C&T documents these procedures in standard operating procedures (SOPs) for LIMS, computer systems, facilities, and sample control.

5.3 Equipment

C&T uses state-of-the-art equipment for processing samples and data, appropriate to the procedures employed. The proper and acceptable performance of our instruments and measurement equipment is of paramount importance to implementing a measurements Quality Assurance program. Procedures for calibration and maintenance of instrumentation ensure that our clients receive technically and legally defensible data. Method- or instrument-specific procedures are detailed in appropriate SOPs. C&T guidelines and method specific criteria established in the SOPs require that each instrument be calibrated with traceable reference materials, which are checked against a second source to prevent quantitation errors. Manufacturer recommended maintenance is performed and, where applicable, specific performance criteria are measured and documented at specified intervals.

SOPs have been developed that establish a system of instrument maintenance and analysis logs to track calibration events, equipment utilization, and samples processed on each instrument. This system allows maintenance and calibration events to be documented for each instrument, and provides instrument operators with historical information needed to quickly solve maintenance problems and conduct repairs. Critical parts inventories and preventative maintenance procedures are incorporated for each instrument system throughout the laboratory.

SOPs have also been developed that establish calibration frequency, acceptance limits, correction factors and other corrective actions for minor laboratory equipment, such as thermometers, balances, ovens, hot plates, and fume hoods.

C&T's LIMS system contains a comprehensive database of all equipment in use at the laboratory. The database treats each instrument as a system comprised of a collection of assets. Each asset is a discrete piece of equipment that can typically be inter-changed with others of like kind to comprise another similar system. As example is a VOC GC/MS analysis system, which is comprised of assets including a Gas Chromatograph, a Mass Spectrometer, Purge & Trap Sampler, and possibly other component assets such as a stand-alone PC data station. The equipment files contain detailed information on each component asset, including manufacturer, model number, serial number, lab and room location, date entered into service, and date retired if applicable.

Each instrument system at the laboratory has a unique identification and number which allows users of the LIMS system to identify the instrument used to analyze a sample or batch of samples. This electronic tracking system is a powerful adjunct to the system of bound instrument (run) logs and maintenance logs described above. The instrument ID system is a key to the sequence number ID system employed by C&T's LIMS which generates a unique ID number for every measurement processed by the LIMS. The 12-digit sequence number specifies the instrument system ID, date, time and temporal order relative to related measurements and calibration events.

Systems have been designed to use this electronic equipment database to schedule preventative maintenance events, automatically track calibrations, and list all samples, QC samples, and calibration events processed by individual instruments.

A summary of laboratory equipment is included in Appendix 3. Contact the laboratory if you require other information about our instrumentation and equipment.

5.4 Data Management Systems

Curtis and Tompkins has developed an advanced system of integrated local area networks (LANs) of computer hardware to automatically collect, reduce, and distribute information and data throughout the laboratory. This integrated Laboratory Information Management System (LIMS) utilizes advanced distributed processing technology between UNIX, and MS-WINDOWS based operating systems. The core of the LIMS system is a relational database UNIX/ORACLE network that provides sample-tracking, a results database, custom electronic and hardcopy reporting, and data management services.

QA for Laboratory Information & Data Management Systems

C&T has designed and implemented a comprehensive complex computer network Laboratory Information Management System (LIMS) for the automated collection, processing, quality control, storage and archival of laboratory data. The primary functions of the LIMS are to provide rapid, automated access to all data that is relevant to the measurement processes, and to automate as far as possible the data quality control and validation processes. This section describes specific quality assurance practices governing computerized data management, which are crucially important to insuring the accuracy and integrity of our laboratory data.

The goals of C&T's LIMS QA program are:

- To insure computer processes and specific programming steps are appropriately and sufficiently documented.
- To insure that electronically reported and stored data reliably represent test results.
- To insure test results and other critical data are secure from unauthorized or inadvertent changes.
- To insure that automated data collection reduction and storage processes are in substantial compliance to government agency and industry recognized standards for ensuring data integrity in automated laboratory operations.

C&T's LIMS QA program is based on the following principles, which define the necessary control issues underlying the automated collection and processing of laboratory data:

DATA: Data corruption can occur at any stage from collection to recall. Acceptable programming control systems must provide evidence of reasonable protection from data corruption.

- FORMULAS: Formulas and programs must be verified by inspection. It is not safe to assume that test or decision criteria are correct.
- AUDIT: Critical transactions and processes should be designed with audit trails for logging transactions. The audit trail generally uses a password or equivalent to identify the responsible users or person(s). The LIMS components and system should be periodically inspected in-depth from raw data through final report.
- CHANGE: Program and process changes are a routine part of LIMS development and evolution, and must be documented. Change control procedures capable of tracking system operations, hardware and software changes should be established. Change procedures should include pre-installation test protocols and appropriate document update routines.
- STANDARD OPERATING PROCEDURES (SOPS): Routine LIMS procedures are appropriately documented. These SOPs are for user training, and available, appropriate user documentation.
- DISASTER: System controls must incorporate planning for unusual events and system stresses. These include back-ups for prolonged total system failure, disk crashes, routine archiving, CPU and power supply failures.
- SUPPLIERS & VENDORS: Laboratory instruments, data reduction systems, hardware, and/or software should meet agency guidelines (i.e.: EPA's June 1990 draft US-EPA document: Automated Laboratory Standards, A Guide to EPA Requirements for Automated Laboratories or US-EPA-GALP's) for design, support, notification, and documentation criteria for the items they supply.

The LIMS QA program and all associated files are maintained by the Laboratory Quality Assurance Director, and implemented by LIMS Developer and staff.

5.5 Supplies

Curtis & Tompkins is dependent on suppliers' capabilities to manufacture and deliver necessary items in a timely manner which conform to product specifications as agreed to by both parties. It is the Department Manager's responsibility to monitor supplier performance on these issues, ensure that incoming reagent checks and instrument verification are completed as needed, and to initiate corrective action in the event of a performance failure.

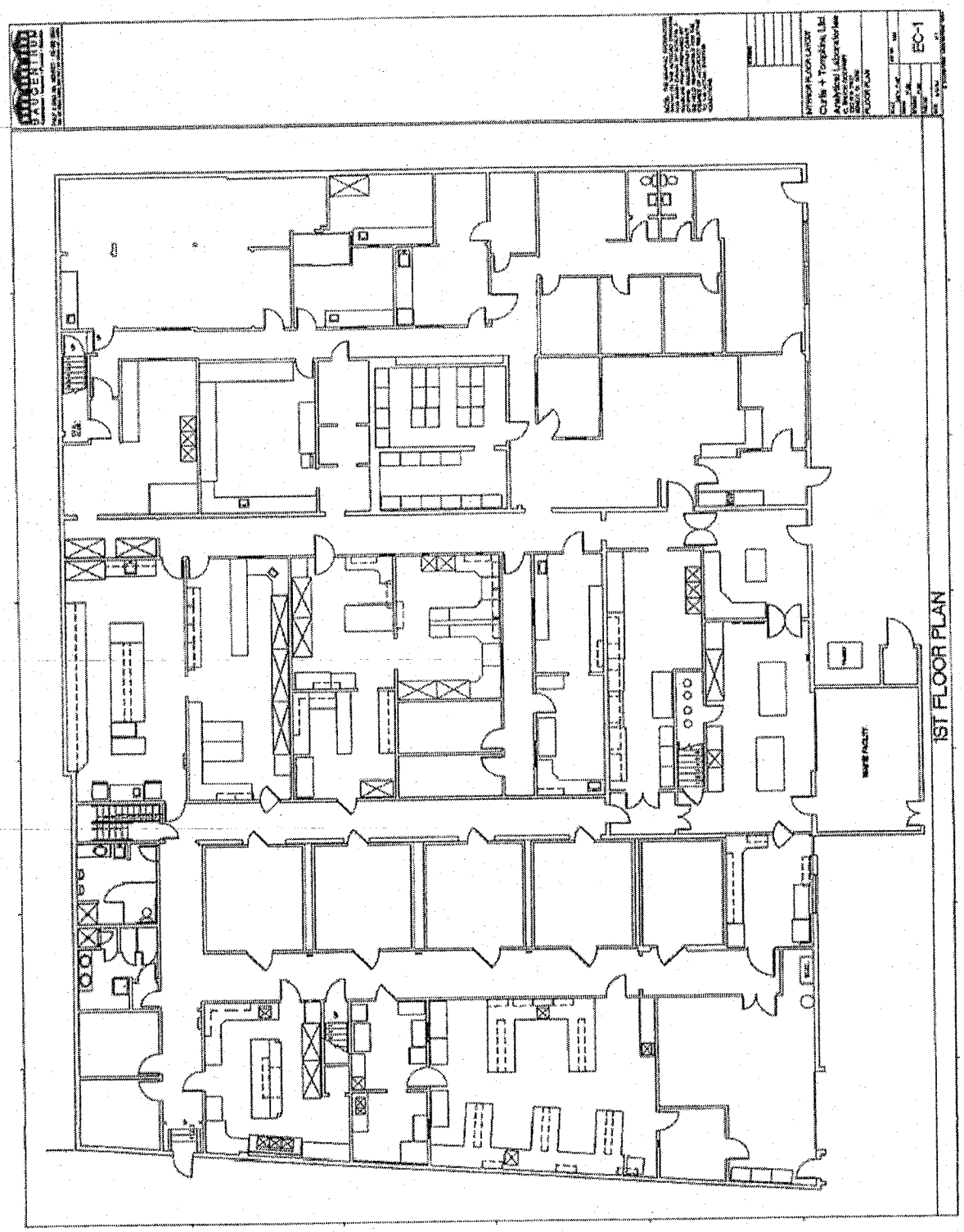
Specific procedures have been written and implemented for screening solvents and reagents used in the measurement process. The screening of these supplies insures that they do not contribute artifacts that influence the measurement process. The screening of solvents and reagents, as well as the manufacturer and lot numbers of reagents and solvents, are recorded as part of the measurement process.

5.6 Preventative Maintenance

Preventive maintenance is vital to the proper operation of analytical instruments and laboratory equipment. Routine, documented maintenance prevents unscheduled downtime and missed holding times or client due dates. It also increases the life span of most equipment. Some instruments and equipment at C&T are under service contract with outside suppliers or manufacturers. Routine maintenance tasks and intervals have been established for many of the instruments employed in C&T's laboratory. Maintenance schedules and tasks for each instrument are maintained in bound instrument maintenance and run logs if applicable. Preventative maintenance, if performed by C&T personnel, is the responsibility of analysts and Department Managers. The documentation that maintenance has been performed, and at what interval, is to be available in the laboratory at or near the instrument, and available for review by the QA Directors, auditors, or others.

Written SOPs and other procedures for preventative maintenance have also been established for smaller equipment such as balances, pH meters, automatic pipettes, from larger more capital intensive equipment like ICP Spectrometers, and Gas Chromatographs.

FIGURE 5.1 **Curtis & Tompkins Floor Plan**



6.0 SAMPLE CUSTODY & SAMPLING

Data generation and processing begins in the field and procedes in much the same manner as a physical sample through the laboratory. The data flows from one part of the laboratory to the next, with reviews at each stage. This chapter deals with the flow of data through the laboratory.

6.1 Sampling Procedures

C&T provides sample containers for many of our clients, in accordance with EPA requirements for container type, size, and preservation. Laboratory SOPs for container preservation and traceability have been developed to ensure compliance with regulatory compliance. Technical assistance is available to our clients from the C&T Client Services Group as needed. Appendix 1 lists appropriate sample size, container type, preservation and holding time requirements for most parameters, for both liquid and solid matrices.

The C&T Client Services Group may occasionally be asked to perform a sampling event. In these instances, a Sampling Plan is prepared and approved by the Project Manager and the client prior to sample collection. Sample Control personnel are appropriately trained in these activities and receive the appropriate certifications (e.g., OSHA 40-Hour) prior to conducting a sampling event.

6.2 Sample Custody

All samples collected by and/or received at C&T are considered to be physical evidence and are handled accordingly. The possession of samples is traceable from the time of sample collection until their final disposition. A sample is considered "in custody" when:

- It is in your actual possession.
- It is in your view after being in your possession.
- It is in a secure area.

The Sample Control Standard Operating Procedures define specific procedures for system and access controls, security, sample receipt, log-in, chain-of-custody, storage, and tracking throughout the analytical process. These procedures are briefly described below.

6.2.1 Sample Receipt

Sample shipments are received through a designated entrance at the laboratory. Sample Control Technicians verify the number of shipping containers being received against the number listed on the chain-of-custody before signing the chain-of-custody. Any damage to the shipping container(s) or other discrepancy is noted, either on the chain-of-custody or on a Cooler Receipt Form. A copy of this document is kept with the project file.

6.2.2 Sample Verification and Log-in

After a shipment arrives, a Sample Control Technician performs a sample inspection. C&T's Sample Control Checklist serves as a training tool and as a list of procedures to follow. The checklist is kept as documentation when it is used or, alternatively, discrepancies are noted directly on the chain-of-custody. Specifics of the inspection include:

- Presence/absence of custody seals or tapes on the shipping containers and the condition of the seals (intact or broken)
- Presence/absence of a chain-of-custody

- Presence/absence of sample tags or labels
- Agreement between sample tags, the chain-of-custody and any other client documentation
- Condition of the samples when received (e.g., cold or ambient; intact, broken or leaking; headspace in VOA vials; etc.)
- Appropriate sample size (i.e. sufficient volume for analyses)
- Correct sample preservation (volatile samples are checked immediately after analysis, not upon receipt).

If everything is acceptable, the chain-of-custody is signed as verified. Any discrepancies are noted and the client is immediately notified. No work proceeds until the problem is resolved.

All samples are entered into the Laboratory Information Management System (LIMS) when they are received. A unique C&T laboratory number is assigned to each sample group and a sequential sample number is assigned to each sample container within that group. The client's name, account number, location, telephone and facsimile numbers, analytical request, date received, and report due date are entered into LIMS. A printout of this information is immediately generated and attached to the client job jacket. The Project Manager then reviews the login summary and stores the job jacket in data management's active file until all analyses are completed.

6.2.3 Sample Storage and Tracking

After sample log-in, all samples are labeled with the laboratory number and the unique container number, and stored under refrigeration at 4°C. Aqueous samples for volatile organic analysis are stored in a separate refrigerator. All sample storage locations are documented.

All analysts and chemists follow internal chain-of-custody procedures to further ensure the validity of all data. All samples are signed out in the Sample Custody Log when they are removed from the refrigerator for analysis. The sample number, date, and analyst initials are recorded in this log. When samples are returned, the date, time, and analyst's initials are again recorded. Chain-of-custody is maintained for sample extracts and digests through signatures in the extraction and digestion records.

6.2.4 Sample Disposal

Samples are disposed of in accordance with the sample disposal SOP approximately thirty days after the final report date unless otherwise requested. The disposal date is recorded for closure of chain-of-custody. Samples are always disposed of in proper manner. The Laboratory Director is responsible overall for the safe and legal handling of all lab waste streams, including waste or residual samples. Sample Control Technicians are responsible for assisting the Laboratory Director in implementing these procedures.

Whenever possible, clients are requested to take back their samples. Transportation of the samples shall be arranged to insure proper safety precautions have been taken. If this is not possible the samples shall be classified according to the procedures listed below. The residual portions of all soil, water, wastewater, and industrial waste samples are considered hazardous and/ or toxic for the particular testing characteristics for which they were submitted.

The hazardous and/or non-hazardous status of all classified waste samples is determined according to Federal, State and Local regulations and exemptions. Residual portions of waste samples are stored in appropriate designated sample storage areas until samples are designated to be disposed (i.e.: walk-in or Delfield refrigerators). Once designated for disposal, residual samples are stored at the laboratory waste storage facility, where they are drummed appropriately,

transported off site, and disposed of properly. Waste samples are stored in proper containers, eliminating or minimizing the possibility of incompatible wastes contacting each other. Waste sample containers are clearly labeled on the top of the container as to their content and status. If either the content or status is unknown, a reasonable explanation of the nature of the wastes shall be clearly visible on the container.

All sample waste transported off-site is properly manifested, and appropriate records are maintained to document the disposition of the waste when it leaves our facility. The Sample Control Technician is responsible for these activities. The Sample Control Technician is responsible for selecting a TSD facility or similar service for all sample wastes handled at the laboratory. Names of qualified suppliers are filed and accessible. Waste treatment, storage, and transportation to a TSD facility is fully documented and these records will be stored for five (5) years.

Waste risk management and prevention are the practice of the company. Staff is regularly trained in waste handling practices. Standard Operating Procedures (SOPS) describe the handling of individual waste streams and unique situations. Emergency response plans have been developed to deal with contingencies of accident and uncontrolled hazard due to laboratory waste.

6.3 Sample Extracts and Digestates

It is C&T's policy to regard all sample extracts and digestates that are "current" with respect to holding times as active samples. The storage of these extracts and digestates is controlled using procedures identical to those described above for samples.

Once holding times for sample extracts and digestates have expired, these sample derivatives are stored, handled, treated and disposed of as described for samples above, and in accordance with procedures defined in Facilities SOPs for each waste stream which the sample derivatives represent.

6.4 Subcontract Laboratory Services

Periodically, C&T has a need to subcontract chemical measurement services which we either 1) do not perform, or 2) are not appropriately certified to perform, or 3) do not have available capacity to perform. When it is necessary to subcontract services the Operations Manager is responsible, through the Client Services group, for the implementation of the procedure as specified in the Subcontract Lab SOP. Clients shall always be informed when C&T uses a subcontract lab.

A list of qualified subcontract labs, and the specific analyses for which they are used, is generated and maintained in the LIMS Seedpak Management Menu under Subcontract Labs. Subcontracted samples are logged in and treated identically to samples processed in the laboratory. Client identity, confidentiality, and custody procedures are strictly maintained. All subcontract labs must be specifically certified and/or accredited to perform the requested procedures required. Evidence of laboratory certifications and accreditations are obtained and filed before the labs are used. Relevant certification programs include but are not limited to, all state certifications, NFESC (Navy), USACE-MRD (Army), AFCEE (Air Force). If applicable, subcontract lab QA Manuals should be obtained and filed at the laboratory. For designated projects, subcontract labs should receive QAPPs, agree to meet project and/or site specific PQL's , reporting conventions, and QC limits, and agree to provide appropriate documentation and information prior to receiving samples. As, and if, needed subcontract labs should be visited for a site review of their procedures. Where appropriate, complete data packages including QC sample data are requested from all subcontract labs.

7.0 PROCEDURES AND METHODS

Analytical methods employed at C&T are generally EPA or other compendial methods, or those specified in the Code of Federal Regulations (CFR) including those found in SW-846 Test Methods for Evaluating Solid Waste or other EPA manuals. At times, industrial methods are utilized to analyze for specific compounds or parameters for which no EPA methods exist. In these instances ASTM or other methods are used. Appropriate methods are used for air samples including NIOSH or other applicable sources. The laboratory Quality Assurance Director maintains documentation of the laboratory's method capabilities. The methods most commonly used by the laboratory are included in the Holding Times and Sampling Containers table presented in Appendix 1.

7.1 Adherence to Accepted Methods

C&T's policy is to adhere strictly to the letter and spirit of compendial methods published by regulatory agencies (USEPA SW-846), industry organizations (WPCF-SMWW), and standards organizations (ASTM or AOAC). Strict adherence to performance parameters specified in published, recognized, and accepted methods insures that our clients receive a defined and recognized product, which will be legally defensible.

Periodically, it is necessary to modify compendial methods to fit C&T's equipment, the sample type received or to accommodate client requests, or meet other requirements. It is C&T's policy that whenever methods are modified either in the performance, acceptance criteria, or in any significant manner, the method reference on the client report will reflect the modification and the modification will be described. Major method variances require approval of regional EPA offices, or adherence to recently developed performance based methods criteria developed by US-EPA.

7.2 Method Selection

C&T performs measurement services according to the methods that its clients request.
If the method(s) requested by the client is inappropriate, technically unsound, or if a substitute method will provide superior results, usability or service, C&T will recommend substitution. Project Managers are most frequently involved in method selection processes. The Operations and QA Directors are also involved in and responsible for this process. Method selection is guided by principles of data usability and the data quality objective process. C&T endeavors to recommend methods that provide the accuracy, precision, and regulatory defensibility required for the intended use of the data. It is C&T's policy to ensure that the labs clients are fully apprised of the utility of the data they purchase.

7.3 Calibration of Lab Equipment

The appropriate calibration of all instrumentation and equipment is crucial to the validity of measurement processes. All C&T analytical SOPs specify calibration procedures by instrument type, calibration frequency, reference standards, calibration acceptance criteria, and calibration documentation procedures. Specification requirements for calibration procedures and practices apply to all measurement process including instrumental (GC, GC/MS, ICP, etc) and general chemistry methods (i.e., volumetric, gravimetric, titrimetric, etc.)

Procedures for assuring that balances, refrigerators, ovens, automatic pipettes, and other minor laboratory equipment are operating within measurable tolerances are established; logs of these measurements are maintained by the designated group.

7.4 Source & Working Standards: LIMS Standards Utility

The acquisition, inventory, general preparation, shelf life, and use of calibration, surrogate, spike, and internal standards is documented and tracked. C&T has developed an electronic database utility within the LIMS for performing this task. Analysts are required to use this utility for documenting the source, concentration, and component identity of all calibration solutions used for measurement processes. References to registered lab benchbooks and page numbers are included in the database for details of solution preparation.

7.5 Documentation of Events & Activities in Lab Benchbooks

At C&T, benchbooks are defined as bound, paginated laboratory notebooks that contain raw laboratory data, notes, and records of activities performed by individual chemists, or groups. Benchbooks are a vital part of proper laboratory documentation procedures. The process of generating legally defensible data requires documentation of all steps in the measurement process. Computer printouts must be generated and cataloged to contemporaneously document measurement activities & information contained on C&T's computer systems. In the modern computerized laboratory benchbooks serve three primary functions:

- Benchbooks provide a means to independently document the validity of data entered or contained in the LIMS using hardcopy data linkages.
- Benchbooks provide a mechanism for documenting events, procedures and observations that are not easily, or not yet established in the LIMS.
- The integrity of control systems associated with automatic data acquisition and digital storage is continually open to question by many of C&T's data users. Benchbooks provide a means of data traceability that lawyers and other officers of the court can understand.

Benchbooks can be important tools for the training and development of chemists. By recording observations and events, benchbooks provide a ready reference to professional experience. Although the LIMS ability to link various data acquisition aspects of laboratory processes provides swift and comprehensive means of relating data to most sample preparation and data acquisition events, many other activities cannot be readily documented in the LIMS. Also, many clients require use of laboratory benchbooks to document activities and processes even if the practice is redundant in electronic systems.

7.5.1 Types of, and uses for Benchbooks

Benchbooks have several uses and users. The primary uses of benchbooks are:

- Sample Preparation. Customized Excel spreadsheets have been developed for many of the sample preparation procedures. These spreadsheets are printed on heavy-duty copy paper and assembled into a bound benchbook prior to use. Write-protected templates for these benchbooks can be found in the QA network directory.
- Instrument or Analysis benchbooks are stored at or near the workstation or instrument to which they are assigned. These typically function to record balance calibration, pH meter operation, DI water system performance checks etc.
- Maintenance Logs are used for recording any changes or adjustments to an instrument that are likely to affect performance, resolution, and/or detection of analytes. Examples include

repairs, preventative maintenance, configuration changes, detectors, columns, new lamps, source cleaning, and all other events of significance. The purpose of logging this information is to allow reconstruction of events for troubleshooting and error detection.

- Sequence Logs, Binders and all notebooks. Computer printed data is essential to the benchbook documentation process. Critical hardcopy reports are dated and signed by the analysts and their content is referenced in a bound notebook to a sufficient level to document the validity of data in the computer output.

- Calibration Standard Benchbooks are for recording the preparation of source, intermediate and working standard calibration solutions. These benchbooks are used for inserting (gluing) source standard certificates of traceability, content, lot # etc. A LIMS linkage exists for book number and page number for the preparation of each working standard solution and for the logging of sources standards. Additional information on the Benchbook to LIMS linkage can be found in the SOP for LIMS Calibration Standards. This SOP can be found in the QA SOP's and on the lab's internal web-browser.

- Personal benchbooks may be assigned to individual analysts to record events and activities on an ongoing basis.

7.5.2 LIMS Logging of Benchbooks

Each benchbook must have a unique number. The location, department, status (active or inactive), function or purpose, and assigned individual must be logged onto the LIMS. If the benchbook is inactive, its archived location must be logged.

LIMS Benchbook Database Field Definitions

NUMBER:	Unique number generated by the system for each book
DEPARTMENT:	Group or Department to which the book is assigned
INDIVIDUAL:	Responsible Individual
LOCATION:	Room number or shelf
DESCRIPTION:	Function, description of the book's purpose or content
STATUS:	Active or Inactive

7.5.3 Auditing Benchbooks

The benchbooks are audited as part of the periodic internal audit procedure, and more often as part of training activities. Compliance to LIMS logging, content, use, clarity and reconstruction testing, and archiving are monitored.

7.5.4 Archiving Benchbooks

Once a benchbook is filled up, the analyst making the last entry in the book, or the individual to whom the numbered book is assigned, is responsible for returning the book to the QA Director who is responsible for implementing the benchbook archival procedure. When benchbooks are removed from active service, the status is changed to 'archived' in LIMS and the archived location is designated. The responsibility for maintaining the integrity and storage of the book(s) is transferred to the QA Director or the QA Director's designee in the Client Services group.

8.0 DATA QUALITY CONTROL & ASSESSMENT

Quality assurance as practiced at C&T consists of quality control and data assessment procedures that are adapted to the specific procedures throughout the laboratory. The use of a general framework adapted to specific activities facilitates training and consistent data generation throughout the laboratory. Routine internal quality systems and data audits are employed to monitor the entire quality program.

The objective for implementing data quality control and assessment procedures is to insure that C&T consistently provides data that meets the quality requirements of its clients, and their data users. C&T's data quality assessment criteria are based on accuracy & precision measurements, are internally generated and documented, or specified in reference publications (i.e. US-EPA SW846); or specified in contracts the laboratory executes with its clients. Overall C&T's primary objective is to satisfy its clients needs and contractual requirements for data of known quality based on adherence to specifications for accuracy, precision, and completeness.

8.1 Quality Control Acceptance Criteria

C&T employs EPA references such as SW-846 and industry accepted standards such as Standard Methods for Examination of Water and Wastewater (SMWW) to determine the appropriate QC parameters and limits for each measurement system. Quality control limits and acceptance criteria have been established throughout the laboratory for calibration, accuracy, precision and completeness. Data are reviewed for compliance to these criteria. Often, because there are multiple uses for the data, several QC limits may apply for the same methods within a lab. Specific procedures for establishing control limits are detailed in the QA SOP for generating control limits. Data acceptability is assessed according to the following hierarchy:

1) Project/ Client specified limits,
2) Internal laboratory limits, and finally,
3) Method prescribed limits.

In all cases, laboratory specific limits are established at levels that meet or exceed method specific QC limits. It is C&T policy to rely on statistically generated QC limits unless contractually required to evaluate data on the basis of a project-specific work plan. Contractually specified criteria are identified and documented by the Laboratory Project Managers; these requirements are then transferred to the analytical departments as described in the Client Services SOPs. Project Managers then review completed reports against the contract requirements.

8.1.1 Establishing Internal Laboratory Control Limits

Control limits are established for all routine tests run at the laboratory. They are determined, in part, from statistical analyses of the results from replicate analyses of Laboratory Control Samples (LCS), and in part on the basis of acceptance limits established by the marketplace. Control limits are established as benchmarks to evaluate the acceptability of QC data generated by the laboratory. C&T monitors the results of LCS analyses to evaluate trends in precision and accuracy, and to comply with requirements dictated by its clientele. The laboratory bases control limits on statistically generated control chart, predictable and communicated needs of its clientele, and the historical ability of the laboratory to meet these limits.

8.1.2 Out of Control Data

Measurement data are considered out of control when the data exceed applicable QC limits. Corrective actions for out of control data vary by method and appear in method specific procedures. Out-of-control data for many methods are automatically identified by the LIMS system through real time and virtual real time QC "filters". Out-of-control events are also identified during data review by analysts, Group Leaders, Department Managers, Project Managers, QC Chemists, or the QA Director.

8.1.3 Control Charts

C&T does not use control charts, but relies on automated LIMS utilities to identify trends and out of control events. The LIMS software automatically collects and analyzes QC sample results, and compares the recovery to the appropriate control limits. The analysts and laboratory managers have access to this data as required. The LIMS can print tabular data and statistical analyses as defined above. Control charts can be generated from current LIMS data using spreadsheet programs if required. Out of control event reports can also be generated automatically by the LIMS.

8.1.4 Control Limits

For analysis of metals and organic compounds, method blank and laboratory control sample data are used to establish statistically derived control limits for surrogate and spike recoveries. The recoveries of all spike and surrogate compounds are collected and analyzed automatically by the LIMS. The mean and standard deviation of an array of determinations, for a specific analyte and method, are calculated by a LIMS utility. Control limits are based on the historical mean recovery plus or minus three standard deviations on either side of the mean, as detailed in the laboratory SOP for generating control limits.

For analysis of many inorganic parameters, control limits are based on method-specified limits and on limits specified by the laboratory's Department of Defense clientele, as these limits are widely accepted within the industry.

The QA Director is responsible for the generating, updating, and maintaining internal laboratory control limits. The LIMS System Administrator is responsible for maintaining the automated utilities (programs) for data collection, statistical evaluation, tabulation and updating limits (for "filter" programs) within the LIMS. The Department Managers are responsible for generating printed information at periodic intervals as needed to address documentation requirements for various contractor oversight, certification and recognition programs.

C&T policy for quality control consists of a tri-level assessment system, each level with its own set of quality control measurements. The three levels are the instrument, the analytical batch, and sample specific quality assessment. In some cases, only one or two of the levels apply, but this concept is widely applicable in the laboratory. The following sections explain each level.

8.2 Instrument Calibration Criteria

To ensure accurate and precise data, C&T must demonstrate its measurement systems are in working order. To this end, calibration criteria, various instrument performance criteria, and similar measurements are made to assess the ability of the instrument system to produce data of acceptable quality.

8.2.1 Instrument Initial Calibration Criteria

First, the instrument is calibrated using traceable standard reference materials. Specific performance criteria on linearity, or curve, response factors and similar measurements are established and adhered to for each analysis. After the initial calibration meets the criteria, a standard from a second source is analyzed at a mid-level concentration. This is an initial calibration verification and is done to ensure that the standards used to calibrate the instrument were reasonably accurate.

8.2.2 Continuing Calibration Verification

When the initial calibration is complete and verified, sample analysis can begin. For most methods, this includes the analysis of a specific number of samples followed by a continuing calibration verification standard that demonstrates that the instrument is still performing in a manner similar to when it was calibrated. An instrument blank analyzed to demonstrate that the instrument is free of "carry-over" or contamination is also part of continuing calibration procedures. This provides the analyst with regular feedback regarding the performance of the system and the need for maintenance or re-calibration. In addition to calibration verification many instrument systems have other performance criteria required to demonstrate the ability of the instrument to measure the analytes of interest. Examples of these performance checks would be the tune criteria for mass spectrometers or the endrin/dieldrin breakdown criteria for the organochlorine pesticide analysis.

8.2.3 Calibration Standards and Material

C&T has developed procedures for using its LIMS to document all aspects of the handling and verification of calibration standard materials. The procedures detailed in the SOP on Calibration Standards describe the use of C&T's LIMS Calibration Standard Database while covering the acquisition, inventory, general preparation and use of calibration standards, surrogate standards, matrix spiking standards, and internal standards.

Information on the source, purity, traceability, and preparation of all calibration materials at C&T are maintained in the LIMS. The LIMS calibration standards database records and tracks all calibration standards as two types: 1) source standards, those obtained from outside sources, and 2) working standards prepared from source standards which are generally the solutions used for calibrating instruments.

The procedure requires written records to document the correlation between unique preparations of calibration standard materials and the electronic records in the database. Full documentation of the preparation of working calibration standards is achieved by linking the intermediate and working standard preparation events to a specific page in a uniquely numbered bound lab benchbook. Certificates of authenticity, traceability and other information are glued into the benchbook pages, or stored in files referenced by the benchbooks. Manufacturer, lot number and other vital fields are recorded in the LIMS and in benchbooks. The LIMS tracks benchbooks through a LIMS Benchbook database utility so that all records are traceable electronically.

The LIMS calibration standard procedure allows all calibration standard solutions to be linked to sample analysis and Batch QC data through the batch number (described below). Similarly, through LIMS serial numbers (unique number for every event, analysis or calibration run through LIMS), all calibration events are linked to the calibration standard's unique ID #, and to the instruments which were calibrated. The LIMS links the unique ID's of all working standards, spiking solutions and the concentrations, identities, and traceability of the individual components to samples, QC samples and calibration events. C&T analysts can, through the use of LIMS tools, automatically perform the following operations:

- identify and invalidate outdated source & working standards
- perform calibration response factor calculations
- prepare calibration reports and statistical evaluations
- calculate surrogate recoveries
- calculate spike/duplicate recoveries & precision data
- prepare calibration standard ID reports for data packages
- track calibration performance of instruments

The calibration materials system requires the date received for all source standards to be recorded and assigns an expiration date based on shelf life for materials. The preparation date for all working and intermediate standards is similarly required by the system to assign expiration dates on the earlier of the date the source expires, or the date the working standard expires.

The shelf life of source and working standards is determined from technical considerations including solution stability, known chemical degradation rates and pathways, data available in chemical references (i.e. Merk Index, CRC Handbook), storage conditions, and practical experience with the materials. The shelf life is established by Department Managers with the consent and approval of the QA and/or Lab Director. Generally, source standards are stable and can be assigned a life of several years, but no longer than 10 years. The shelf life of all source standards determines the shelf life of the working standards. A working standard expires on the day a source standard for the component expires; working standards cannot outlive the source standards from which they were created.

8.2.4 Criteria used to evaluate calibration events

In general, an initial calibration (ICAL) must be performed whenever instrument conditions have been altered or the daily calibration no longer passes acceptance criteria. Acceptance criteria based on the Relative Standard Deviation (RSD) of the ICAL response factors (Rf) or linear correlation coefficient pertaining to each compound of interest is reduced in statistical format. Individual method procedures specify the calibration acceptance criteria and calculations in detail.

For ongoing calibrations, criteria based on % Difference (%D) have been established for Initial Calibration Verifications (ICV) and Continuing Calibration Verifications (CCV). Individual method procedures specify the calibration acceptance criteria and calculations in detail. Appropriate calculations are defined in each analytical SOP.

8.3 Batch QC

Samples are batched together by matrix and analysis. Each batch of samples (20 or fewer samples of the same matrix type prepared using the same reagents, standards and procedures in the same time frame) is processed with a set of specific QC samples that are used to assess the performance of the entire measurement process (sample preparation, analysis and data reduction). Analysts are responsible for defining a batch within the constraints defined in this manual, the specific method, and programming in the LIMS. C&T's LIMS assigns a unique batch number identification to which all QC samples are linked and compliance criteria are automatically evaluated.

Each batch is required to contain a method blank to assess contamination and prevent false positive results. To assess performance with respect to precision and accuracy the batch contains a Laboratory Control Sample (LCS). Other QC required in each batch are specified by the method

SOP, and specific contractual requirements. C&T's LIMS system assigns unique QC sample identification numbers, linked to the batch identification for every QC sample processed in the batch. The correlation of QC sample results to sample results is managed through the LIMS batch identification number.

The following types of QC samples are included as part of C&T's batch QC assessment procedures. Requirements for specific types of QC samples, their frequency, evaluation criteria, acceptance limits and corrective action criteria are specified in the method procedures (SOP), and in QAPPs submitted by clients. Procedures for preparing and analyzing batch QC samples are discussed in each method SOP.

8.3.1 Laboratory Control Sample (LCS)
An LCS is a matrix-specific blank sample, (e.g. sand for soils/solids and reagent water for liquids) spiked with a representative or comprehensive selection of the target analytes. The LCS is prepared and analyzed in exactly the same manner as the samples in the batch. The LCS results demonstrate the performance of the measurement system in the absence of matrix effects. LCS results are evaluated by comparing the known sample concentrations with those calculated from the measurement system using percent recovery (%R) calculations. Acceptance criteria are established for minimum and maximum recoveries for each analytical method.

8.3.2 Matrix Spike Samples (MS)
A matrix spike is one sample in the batch to which a know concentration of representative (or comprehensive) selection of the target analytes has been added. The matrix spike results demonstrate the accuracy of the method in the matrix being analyzed.

8.3.2 Matrix Spike Sample Duplicate (MSD) or Laboratory Control Sample Duplicates (LCSD)
Matrix spike or laboratory control sample duplicates are used to evaluate both the accuracy and reproducibility (precision) of the measurement systems or test methods. Precision is evaluated by comparing the concentrations, as determined for duplicate sample analyses, using Relative Percent Difference (RPD) calculations. Acceptance criteria are established for the maximum acceptable RPD for each method. In the absence of sufficient sample to perform two matrix spike samples, two LCS's are prepared and substituted for the MS and MSD.

8.3.3 Sample Duplicates
Sample duplicates are used to evaluate the reproducibility (precision) of the method on a given matrix and to gain information on matrix effects. Precision acceptance criteria for duplicates are established based on maximum RPD values.

8.3.4 Quantitative evaluation of precision and accuracy
Precision and accuracy are evaluated by calculation of percent recovery (%R) and Relative Percent Difference (RPD).

The percent recovery of a component is the quotient of the spike result less the sample result (if any) of the component divided by the amount of spike added multiplied by 100.

$$\text{Percent Recovery} = (SSR - SR) / SA \times 100$$

Where SSR = Spiked Sample Results, SR = Sample Result and SA = Spike Added

The Relative Percent Difference (RPD) is the quotient of the first sample result less the second (duplicate) sample result divided by the mean of the results multiplied by 100.

$$RPD = |(R1 - R2)| / ((R1+R2)/2) \times 100$$

Where R1 is the result of the first analysis, and R2 is the result of the duplicate analysis.

Specific mathematical definitions of other calculated QC parameters and data reduction algorithms appear in the SOP's for each measurement method, and are comprehensively addressed in the QA Procedures SOP on calculations. Acceptance criteria are established so that the analyst can objectively and rapidly assess the quality of the data.

With as many measurements as the laboratory performs, the wide variety of matrix types that the laboratory receives, and because acceptance criteria are based on a 99 percent confidence interval, QC parameters do at times fail to meet acceptance criteria. In the event that a particular limit is exceeded, the analyst must determine if the failure invalidates the entire batch. To facilitate this assessment the Batch QC Assessment Matrix (Figure 8.2) is used to determine the disposition of the batch.

8.3.5 Method Blanks

Each batch is required to contain a method blank to assess contamination and prevent false positive results. In the event that a method blank results in a value above the method detection limit, the analyst uses the Method Blank Flowchart (Figure 8.1) to determine the impact on the sample data in the batch. As required by the Navy, if the contamination is less than the reporting limit, a note is placed on the internal case narrative; if the contamination is greater than the reporting limit, the data is qualified and discussed in the final hardcopy report.

8.4 Sample Quality Control

In many analyses there are methods of determining the performance on particular samples. For organic compound analyses, surrogate spikes, a non-target analyte added to each sample and QC sample prior to extraction or sample preparation, assist with determining the accuracy of the analysis on a particular sample. Failure to meet %R acceptance limits may result in the reanalysis of a single sample, unless obvious chromatographic interferences are present. Repeated failure indicates that the sample result may be biased, or that the sample is not amenable to analysis by the method being used. Other sample specific controls include:

- precision between repeat injections,
- internal standard response (where this calibration technique is used),
- interference check standards and samples for AA and ICP measurements,
- post-digestion spikes for AA and ICP analyses,
- method of standard addition (MSA) analyses for AA and ICP measurements.

Specific applications of these techniques are method-dependent and are described in detail in the method SOPs.

8.5 Audits and Scheduled Quality Assessments

In addition to assessing environmental data for precision and accuracy, C&T participates in several types of assessment programs.

8.5.1 Performance Evaluation Samples

Performance evaluation samples are obtained from third-party, NVLAP-certified sources and analyzed by C&T. The results are reported back to the agency or supplier who then evaluates the results against the known or true values and provides C&T with a performance report. These reports are used to determine corrective action and method development priorities and to demonstrate comparability of the data produced by C&T with results generated by other laboratories analyzing the same samples. C&T participates in at least 2 performance evaluation studies annually, for each type of regulatory program (Safe Drinking Water Act, Clean Water Act, and Resource Conservation and Recovery Act). This includes WS (Water Supply), WP (Water Pollution), UST (Underground Storage Tank) and SOIL studies that are purchased from NVLAP-accredited third party suppliers. Many clients also send performance evaluation samples to the laboratory as part of project quality requirements.

8.5.1.1 Internal Quality Control Samples

C&T employs a number of internal QC samples to assess performance of methods, instrument systems, analysts or all of these variables, as well as monitoring the routine performance of Laboratory Control Samples (LCS). The results of these events initiated by the QA Director are tabulated, evaluated and used to improve lab performance.

8.5.2 Internal Audits

The QA Director will conduct internal audits periodically. In addition to scheduled audits, random audits of specific procedures or areas are an effective means of ensuring that QA practices such as method and SOP compliance and documentation is maintained at all times. Two types of internal audits are performed annually. Quality Systems Audits are performed to evaluate the effectiveness and implementation of quality control systems established in this manual, and detailed in the SOP's. Data quality audits are performed to assess the quality and integrity of data archived by the laboratory.

8.5.2.1 Quality Systems Audits

QA Systems Audits are the type of audit most frequently performed by clients and certifying agencies. They are designed to evaluate the implementation of quality control systems within each group of the laboratory. Procedures for performing the Quality systems audits including group specific checklists have been developed and appear in QA SOP's. This type of audit is to be performed by either the Lab or the QA Director at least once annually.

8.5.2.2 Data Quality Audits

Data Quality Audits are performed once annually across all groups to thoroughly evaluate the integrity and quality of the data generated and archived by the laboratory. Data quality audits involve a full reconstruction of reported results from the lowest level of raw data archived. They are designed to demonstrate compliance to data collection, storage, and archiving procedures. Data quality audits are to be implemented for each test product routinely performed by the laboratory. Procedures for performing data quality audits including GC and GC/MS Tape audits appear in the QA SOP's.

8.5.3 External Audits

External audits are performed by state agencies, third party accreditors, clients and their contractors. C&T is dedicated to providing information to clients regarding procedures and QA practices.

8.5.4 Annual Audit Activity Summary Reports

The QA Director is responsible to prepare an annual report of all audit activities both internal and external, conducted in the laboratory. The report is designed to summarize the results of all internal and external audit activities. Summaries of findings, observations along with exceptions and disagreements are to appear in this report. The recipient of the report is the Lab Director and President.

8.6 Comparability, Representativeness and Completeness

Three less quantifiable quality criteria are comparability, representativeness, and completeness of the data generated for a particular project. With respect to comparability of data, C&T's inhouse control limits and participation in performance evaluation studies, which compare results among a number of laboratories, demonstrates that the laboratory, given the same sample as another laboratory, can generate comparable data. Representativeness and completeness have to be assessed on a project level, against regulatory holding times, field duplicates, and project-specific laboratory QC. Laboratory duplicates provide an indication of the ability of the laboratory to select representative aliquots of the samples provided, but does not provide information regarding the representativeness of the samples taken for a project with respect to the scope of the project. The percentage of data generated by the laboratory for a project that meets all analytical data quality objectives is just one measure of the overall data completeness for a project.

8.7 Method Validation & Method Detection Limit Studies

The implementation of a new analytical method requires a Method Detection Limit study, valid initial and continuing calibration, and the compliant analysis of two laboratory control standards (LCS) and at least one PE sample from an outside source. The performance of this validation study must be on file at the laboratory, associated and supporting raw data shall be filed with the validation report or obtainable in the archive lab records.

Method detection limit (MDL) studies are conducted to demonstrate the lower limits of detection for which a method including all steps for sample preparation, treatment, extraction/digestion, clean-up, and instrumental analysis procedures is capable of performing. MDL studies are performed annually and when significant changes in procedures for sample preparation, cleanup or instrumental analysis are implemented. When the lab has more than one instrumental measurement system for a given test procedure, and these systems have significant differences in responsiveness to the same analytes, the lab will establish MDL's for each instrument. C&T has established a comprehensive procedure (QA SOP's MDL Procedure) for performing & documenting MDL's including all data reduction algorithms and documentation requirements.

Figure 8.1 Method Blank Acceptance Flowchart

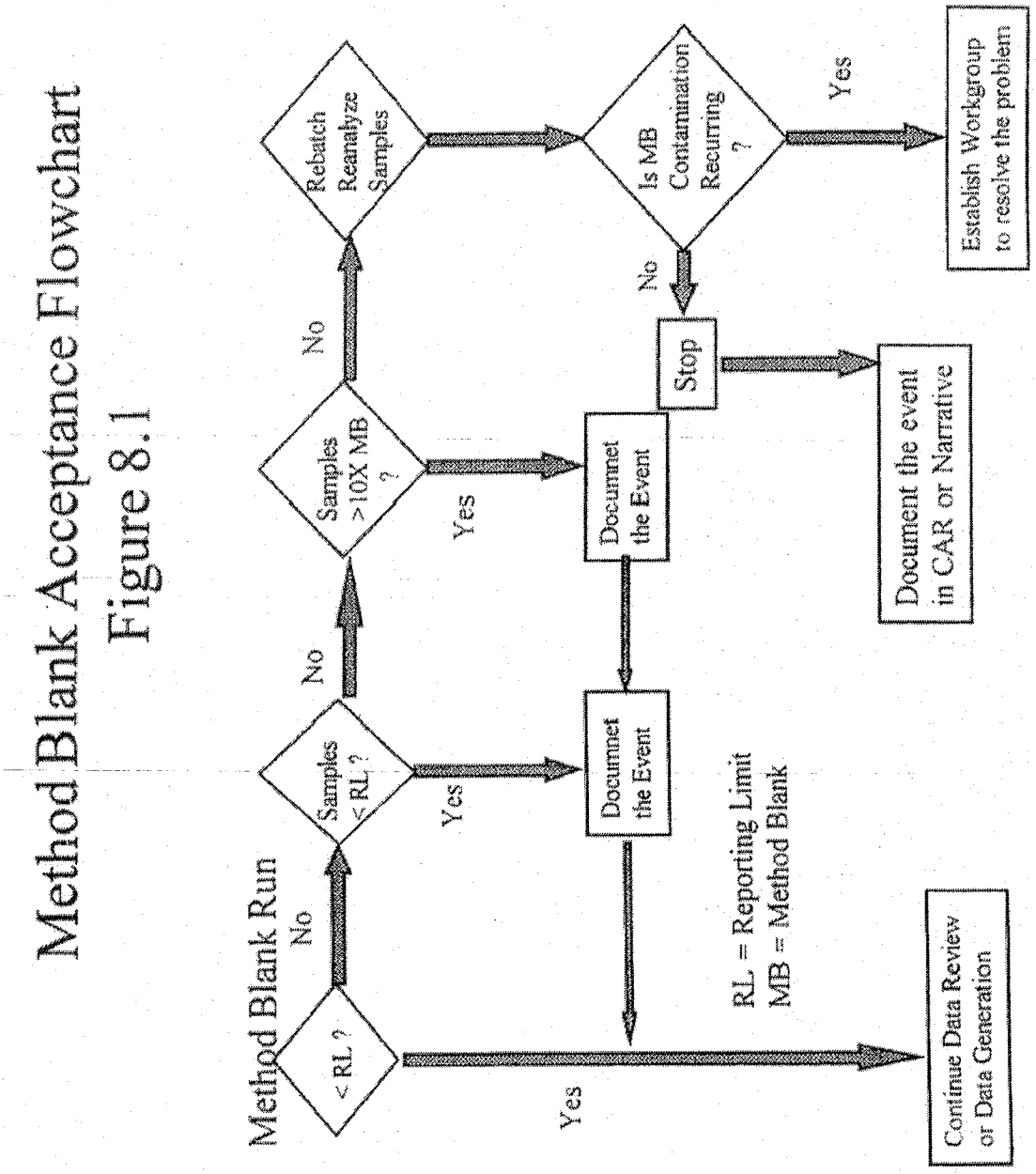


Figure 8.2 Batch QC Acceptance Matrix

BATCH QC ACCEPTANCE MATRIX + PASS, - FAIL								
CASE	1	2	3	4	5	6	7	8
LCS %REC	+	+	+	+	-	-	-	-
MS, MSD %REC	+	-	+	-	+	-	+	-
MS, MSD %RPD	+	+	-	-	+	+	-	-

LCS %REC: The analyte concentrations in a laboratory control standard (LCS) are determined as a percentage of the known concentration of the analyte(s) in the LCS. Acceptance limits are established for the method and defined in the SOP's.

MS/MSD %REC: The Matrix Spike (MS) and Matrix Spike Duplicate (MSD) %Recovery determinations demonstrate the accuracy of the measurement system on sample matrices. The analyte concentrations in an MS and MSD are determined and compared to limits set in the SOP's for each method as a percentage of the known concentration of the analyte(s) added to the samples.

MS/MSD %RPD: The relative percent difference (RPD) of duplicate recovery measurements from the MS and MSD are determined and compared to limits set for each method as a measurement of the precision of the measurement system.

Evaluations of Batch QC Sample Measurements

Case 1: Batch QC data are acceptable.
Case 2: Batch QC Data is acceptable; matrix effect confirmed.
Cases 3 & 4: Batch QC data are unacceptable. Data are rejected, all samples in the batch must be re-extracted and reanalyzed *unless sample matrix problems are determined and documented.*
Case 5: Batch QC data are unacceptable. Data are rejected, all samples in the batch must be re-extracted and reanalyzed *unless an isolated LCS problem is determined and documented.*
Cases 6, 7 & 8: Batch rejected. Data are rejected; all samples in the batch must be re-extracted and reanalyzed.

9.0 DATA REVIEW

9.1 Peer Review Process

Second party review is a fundamental principle of quality control for analytical data. At C&T we follow this principle through the application of a peer review program. This program is supplemented by Department Manager review as a training and management tool. All analytical results, whether generated by computer systems or through manual calculations, are reviewed by a second party to prevent simple errors from being reported.

For all activities where analysts are entering data into the LIMS a second party review is required. Daily procedures such as sample digestion or extraction must be verified through the peer review of data. Infrequent or irregular procedures will also be subjected to second party review and files documenting this process must be maintained. All reviews must be documented by signing on the pre-printed "Reviewed by" line or through the use of the "Reviewed by" ink stamp that is available throughout the laboratory.

Standard data package preparation and review is completed as follows: When an analyst completes a batch of data or a client job, he/she prepares the data package according to the appropriate SOP. The analyst initiates a review checklist and verifies the contents and accuracy of the data package using the checklist as a guide; controlled copies of these checklists can be found in the Quality Assurance SOP's. The analyst then signs off on the data package and passes it to a peer for review. This review includes a 100% verification of the original analysis, again using the checklist as a guide. Both the analyst and peer reviewer must be familiar with the data package requirements for the analysis (specifics are located in the appropriate analytical SOP) and have been designated as a peer reviewer by the Group Leader or Department Manager.

It is the responsibility of the individual performing a specific activity to secure a peer review in a timely fashion. Department Managers are responsible for verifying that infrequent tasks are reviewed in a timely manner. Individuals using the data in the next step (analysis of extracts or digestates, or preparing reports) must verify that the data have been reviewed. If the review has not been done they must alert the responsible individual who must obtain review. Unreviewed data cannot be passed on to the next step in the process. An individual can request that the next person to utilize the information perform the peer review, but it is the party actually doing the work who is responsible for securing a second party review prior to the data proceeding in the system.

All data are subject to second party review within the group to prevent simple transcription or calculation errors. Both the analyst and reviewer must initial the data prior to sending it to the Client Services Group for reporting.

All analytical records, including QC data, are generated and stored as described below.

9.2 Analytical Data Review

C&T's quality program requires 100% peer review of all analytical data and up to 10% of all data must be reviewed by the QA Director or his/her designee. The analyst completing the work is responsible for securing peer review prior to passing the data to the next step in the system (usual final report and client data package preparation). The Peer review process must include the following procedures:

- Each data package must include a review checklist that is initiated by the analyst performing the analysis. The first thing the peer reviewer must check is whether or not the analyst has completed the review checklist. If this has not been done the data package is returned immediately to the analyst for completion. It is not the responsibility of the peer reviewer to finish the work of the analyst.

- The peer reviewer then completes each step in the checklist. If a calculation is verified, this is written directly on the raw data accompanied by a date and initials to demonstrate that the calculation was verified. Notes concerning the QC are recorded directly on the checklist. Any questions concerning the data are taken first to the analyst, and then to the Group Leader or Department Manager if the analyst and peer reviewer cannot reach a consensus. All decisions regarding the data should be clearly documented. All QC outliers must be clearly documented, the reason for reporting the data logically stated, and the participating parties must initial and date the records.

- Every item on the checklist must be completed prior to the peer reviewer signing off on the data package. Unanswered questions must be taken to the Department Manager or Group Leader for resolution prior to signing off on the data package. It is the responsibility of the peer reviewer to assure that the data is complete and can be reconstructed.

- When the peer reviewer is confident that the package is complete and correct, the checklist is signed and dated in the appropriate space. The data package is then passed on to the Group Leader, Department Manager, or QC Chemist for review.

9.2.1 Semivolatile and Volatile Organics

The sample preparation (extraction) associated with organic analyses utilizes method-specific bound notebooks to record all data associated with sample extraction and preparation. Alternatively, the process can be documented in LIMS and a batch report used as documentation of the extraction process. In either case a copy of the record is transferred to the appropriate analyst with the sample extracts and becomes part of the permanent record.

The Gas Chromatography (GC) and Gas Chromatography/Mass Spectrometry (GC/MS) analyses utilize either computer generated sequence files or instrument-specific bound benchbooks for injection data. Computer generated quantitation reports, chromatograms, and mass spectra are filed by analytical batch number. The analytical and QC results are reviewed by the analyst before submittal to the Department Manager, or their designee, who approves the data and transfers it to the appropriate project file where it is maintained.

9.2.2 Metals and General Chemistry

The sample preparation (digestion) associated with metals analyses utilizes a bound benchbook to record all data associated with sample digestion and preparation. A method number, designation of whether Inductively Coupled Plasma Spectroscopy (ICP), Flame Atomic Absorption (FAA) and /or Graphite Furnace Atomic Absorption (GFAA) digestion was performed is recorded by batch in the notebook. A separate benchbook is maintained for all cold vapor atomic absorption spectroscopy sample preparation. A copy of the appropriate digestion logbook is transferred with the digested samples to the analyst and after that, with the analytical data to the Department Manager for review.

Records for metals and other inorganic parameters analyzed using automated instrumentation (ICP, GFAA, Ion Chromatography, etc.) are maintained in instrument-specific benchbooks.

Computer printouts from these instruments and copies of the run logs are reviewed and initialed by the analyst prior to final review by the Department Manager or their designee. The data is then transferred to the project file where it is maintained.

All records for tests using non-automated general chemistry techniques are maintained in method specific notebooks. Copies of these notebook pages are submitted to the Department Manager for review along with the reduced, final result that is recorded on an analytical worksheet or spreadsheet.

9.3 Peer Qualifications

It is clear that in order for the peer review program to function, the reviewers must meet certain minimum requirements. Analysts new to a particular procedure are not qualified to complete the review of another analysts' work. Department Managers are responsible for determining if an individual has sufficient knowledge in a particular analysis to complete the review. It may not be necessary to be proficient in the actual analysis to be capable of performing peer review for that analysis. While the GC pesticide chemist may not be able to sit down and run the GC volatiles procedure they are sufficiently proficient in gas chromatography and the required procedure to be trained to complete the peer review.

Department Managers are responsible for determining the skills necessary for peer review of each analysis in their group. As it is the goal of the documentation to make the analytical process clear to an individual who has not actually performed the analysis, it will not be necessary for all reviewers to be proficient analysts in each procedure. Familiarity with the appropriate SOP, compendial method, and QC criteria is a requirement.

Department Managers are responsible for maintaining lists of peers for each analysis. Peers need not currently be assigned to the work group (many Project Managers can serve as peer reviewers if necessary for analyses in which they are trained) but must be familiar with the procedures and the SOP. It is the Department Manager's responsibility to provide sufficient training (and documentation of training) to have two peers available for every analysis within their group.

9.4 Department Manager Data Review, Reporting and Verification

Department Manager review is necessary to assure that the decisions made by analysts of different experience levels are acceptable. This review has two distinct parts:

- Department Managers are responsible for determining that qualified individuals have completed the review process appropriately. The Department Manager or QC Chemist must review Any QC outliers that are to be reported to assure that the logic is sound and expressed in an understandable manner. The date and Department Manager's initials must appear by each explanation to confirm that the decision is acceptable. This review must be completed by the Department Manager for all data generated by the group.

- In addition, Department Managers must perform a complete review of 10 percent of the data generated in their group. This task can be done by the Department Manager serving as the peer reviewer on at least 10 percent of the data generated in his/her group. It is the Department Manager's responsibility to maintain a balance in this level of review, making sure that they review 10 percent of the data generated by each analyst to assure that on going training is provided to all analyst. This review is documented in the same manner as regular peer review.

9.5 Data Entry

Final results and associated quality control are reported daily by analysts through the Department Manager. Any QC results falling outside acceptable limits are appropriately flagged and an explanation included on the report.

After the analysis is listed as complete for that sample set, a report is generated. At this point, the report is transferred to the appropriate Project Manager for final review.

9.6 Project Management Review

Each project is assigned to a Project Manager when the samples are received at C&T. This individual is selected based on the scope of work, familiarity with a particular client's requirements, laboratory workload, or, in some cases, upon the client's specific needs or requests.

The Project Manager is responsible for tracking the progress of the samples from the time they are logged into the laboratory, through analysis, and until the analytical data are reported to the client.

Once an analytical report is complete, the Project Manager reviews the final report against the following criteria:

- Reasonableness of Data: The data are reviewed as to whether the results reported on various analyses are internally consistent. They compare analyses such as BOD and COD, and the amount of organic contamination reported; general mineral balances; volatile organics measured by different methods; TDS and specific conductivity; and other chemical relationships. They also compare data on samples within the same project file, and if descriptive information about the samples is available, may conclude that the results are reasonable in comparison with each other or known site history. In some instances the Project Manager will ask the laboratory staff to try to discover the source of a discrepancy. If the discrepancy cannot be resolved the client is informed.

- Accuracy in transcription of names, dates, sample number, results, and consistency in labeling throughout the report.

- Acceptability of QA/QC Data: The Project Manager ensures that the QC data are within acceptance limits and that appropriate QC data are included in the final report. If a QC parameter is outside acceptance limits, the Project Manager ensures that an appropriate explanation is included in the report.

The Project Manager and the Operations Manager (or a designee) then sign the final report. Questions about final reports should be directed to the Project Manager, or to the Operations Manager.

9.7 Quality Assurance Data Review

The Quality Assurance Director is responsible for reviewing at least 10% of the data reported by each analytical department, including the final reports assembled by the Laboratory Project Managers. This review is intended to verify that all laboratory personnel routinely implement the laboratory's quality systems and that the data meets method, client, and regulatory requirements.

10.0 DATA STORAGE & DOCUMENT CONTROL

All data and reports are archived on computer tape, CD ROM or other electronic media and in hard copy form. Archival storage in all formats is limited to a period of no less than five years as required by NELAP. Data may be retained for longer periods of time, either on-site or off-site as required by the laboratory's clientele. Storage of archival data for more than 5 years requires project or contract specific written approval of the Lab Director, and in many instances advance compensation for anticipated storage and cataloging costs.

10.1 Archival Data Storage & retrieval

Archival data are typically stored at the laboratory for one year after the date they were generated, or longer, depending on space available and specific client data storage agreements. Long term archival data are cataloged, transported, and stored offsite by a records-management contractor. Archived data is maintained at C&T's cost for the use of our clients and stakeholders and they are regarded as the sole property of C&T. Data retrieval from offsite storage is considered a service provided by C&T to it's clients and as such these requests are subject to fees. C&T regards its client relationship protected by attorney client privilege. Accordingly, C&T will not release archival data to any third party without specific written authorization of the client who paid for the data. Subpoenas for records received by C&T will be submitted to the client for their sole action.

10.2 Data Security & fraud

C&T maintains controls to insure that the ethical practices are implemented at our laboratory. Effective procedures to control for the most common types of laboratory fraud rely primarily upon the individual integrity of the data generator. For this reason, we focus our training and efforts at defeating lab fraud on the individual. The following systemic control procedures have been developed to protect C&T and its clients from incidents of fraudulent data generation practices.

10.2.1 Integration Procedures: Controls for "Peak Shaving"

Peak shaving is defined as the practice of inappropriately manipulating chromatographic peak integrations by lab automation software for the purpose of making what would *obviously* be noncompliant data adhere to specifications. *Peakshaving* is usually confined to chromatographic peak integrations involving calibrations, surrogate and MS/MSD spike recovery data.

C&T conducts formal training classes to define the practice and clarify C&T policies, work rules and ethical issues involving data manipulation practices. The guidelines covered for this practice are outlined below.

Hardcopy raw data, printed for review and filing should contain, to the greatest extent practical, the integration limits and baseline information. C&T's policy is that manual reintegration of CLASS data files is a matter of professional judgment. We allow analysts to manually manipulate and reintegrate data files within defined guidelines using professional judgment. Manual integration, if performed, must follow a pattern of consistency. This guidance refers to the consistent treatment of similar data. For example, continuing calibration files should be integrated in the same fashion as initial calibrations. Surrogates and matrix spiking compounds in samples with similar matrix effects should be consistently integrated.

Any data that is manually integrated must be flagged as such by the data acquisition software. It is not permissible to alter, by deletion, the chromatogram or the data flags. It is not permissible to change the data file to the extent that it does not conform to the definition of raw data. It is not permissible to delete peaks or "alter the picture" by deletion.

Unacceptable file manipulation is defined as an obvious manipulation of the chromatographic data for the purposes of obtaining a compliant result, when that result could clearly and only be obtained by an inappropriate manipulation of the data.

The Standard Operating Procedure (SOP) for the method shall specify parameters for integration and conditions for manual modification of automatic integrator presets. The SOP shall detail the flagging conventions used by the data reduction software to indicate that a manual integration was performed. Allowable manual reintegration for the sole purpose of improving the QC compliance data, and only for this reason, is not permissible.

10.2.2 "Time Travel" Controls

Time travel is the practice of turning off a LAS or instrument control computer, resetting the date/time clock and performing an analysis at an erroneous date & time, for the purpose of meeting data quality objectives, usually holding time for samples.

The primary systemic control mechanism for time travel rests with two, and if needed three, separate timekeeping systems in the data collection process. The LIMS data collection systems are designed in a manner such that time travel cannot occur as a result of one person acting alone. The primary clock for datalogging at each C&T facility shall be the LIMS server (Sun SPARCstation) clock. LAS clocks (i.e. HP-UX, TJA-Thermospec) are secondary clocks. Tertiary clocks are instrument control and acquisition computers or devices (i.e. PC's connected to an LAS). Only those individuals authorized as database administrators will have the required security clearance sufficient to set (or reset) the LIMS Server system clock. For valid data to be entered on the system at an incorrect time, both the LIMS clock and the data acquisition or LAS clock must be reset to within plus or minus 30 minutes of the same time. For this to occur, the User/Data generator and the DBA must operate together, simultaneously & in a conspiratorial manner.

10.3 Distribution and Document Control Procedures

C&T has a system of controls for documents to insure that current documents are in use, and that superseded documents are filed in appropriate records. The following documents are relevant to the Quality Assurance Program, and procedures for dealing with them are appropriately addressed here:

- QA Program Manual
- Standard Operating Procedures

Standard Operating Procedures are in place for the procedures for updating these documents.

10.3.1 QA Program Manual

The QA Program Manual shall be reviewed and revised at annual intervals. The President is responsible to see the task is completed, the QA Director is responsible for implementing the procedures for distribution of current versions, and replacing and archiving obsolete versions. The following addresses specific procedures applicable to the QA Program manual.

10.3.1.1 Controlled versions of the QA Manual
One controlled version of the QA Manual will be issued. All copies of the QA Manual made from the original are specified as uncontrolled. If a client requests a controlled copy for a legitimate reason, an original controlled copy will be printed, signed by QA Director, Operations Manager, and Lab Director and distributed by the QA Director. The QA Director shall maintain a log of those receiving controlled copies.

10.3.1.2 Revision/ replacement
When a QA Manual is superseded with a new revision, the original controlled copy is placed in archives. All copies of the outdated version, except the archived original, are to be destroyed when the new version is released. Each employee is required to read each new revision of the laboratory Quality Assurance Manual and to sign a statement of understanding. The original is maintained in the Quality Assurance files and a copy of the statement is placed in the individual's personnel files.

10.3.1.3 Expiration
C&T QA Manuals expire one year after the revision date. Therefore all copies of C&T QA Manuals that have revision dates more than one year old are outdated and are to be destroyed by those who possess them.

10.3.1.4 Revision frequency
The QA Program Manual shall be revised annually. The President and the QA Director shall be responsible for preparing modifying, production and approval of the manual each year.

10.3.1.5 Distribution
Distribution of the current version of the QA Manual is the responsibility of the QA Director. The QA Director is also responsible for collecting and destroying all copies in the lab, as well as archiving the original controlled copy.

10.3.2 Standard Operating Procedures (SOPs)
SOPs are developed, revised, reviewed, approved, distributed and controlled according to the requirements specified by the National Environmental Laboratory Accreditation Program (NELAP) Quality Systems Standards (Ch.5, Section 5.10) and the Department of Defense Quality Systems Manual for Environmental Laboratories (DoD QSM), as outlined below. The QA Director is responsible for implementing the SOP document control and revision procedures.

10.3.2.1 Format
The format for SOP's is specified in the NELAP Quality Systems Standard, Section 5.10 and each SOP for analytical methods generally contains the following elements:

- Title and Signature Page: Contains the title of the document, the appropriate revision number, the date the document became effective, a unique identification (consisting of the volume and section numbers), revision number, approval signatures, and signatures of qualified analysts. Typically, SOP's are reviewed by the individual responsible for implementing the procedure, and approved the responsible individual's supervisor and the Quality Assurance Director (or their designees).

- Header Information: A header must appear on each page of the SOP and must contain the following information in this order:

SOP Volume:	the book where the printed SOP's are stored
Section Number:	assigned using the C&T SOP Table of Contents
Page Number:	(e.g., 1 of 4, etc.)
Revision Number:	whole numbers, beginning with 0 for new SOP's
Effective Date:	date the revision supercedes the previous version
Filename:	describes where that particular SOP resides in the laboratory's electronic network

- Scope: Briefly (one or two sentences) describe the purpose of the SOP. For analytical SOPs it is appropriate to include applicable matrices and reporting limits.
- References: Cite the compendial methods used in generating the SOP.
- Sample preservation & regulatory holding time.
- Modifications: List deviations from the reference method.
- Safety: List any special safety requirements or concerns that may be encountered in the performance of the procedure.
- QC Requirements: List the QC requirements of the method (e.g. method blank, LCS, matrix spike, calibration, etc.) and applicable corrective actions.
- Interferences: A brief discussion of potential sources of high or low bias.
- Procedure: The steps required to perform the analysis, including calibration, sample preparation (may be included by reference to a separate SOP), typical instrument settings & conditions, reagents, standards, and example equations used to calculate sample and batch QC results.
- Pollution Prevention & Waste Disposal.

10.3.2.2 Review, approval, and implementation

If the document is an SOP for use within Client Services or the analytical departments, the SOP must be approved, signed, and dated by the Department Manager and the QA Director (or designees in their absence). The SOP must include the date that the revised procedure supercedes the outdated version.

If the document is an SOP is for the QA Program, the SOP may be generated without a title page and may be signed by the Laboratory Director or the QA Director.

10.3.2.3 Document control

Controlled copies of an SOP reside in the labeled volume with the QA Director and in the appropriate Workstation Notebooks. When superseded by a revision, one controlled copy of the outdated SOP will be archived by the QA Director; all other copies are to be destroyed. To control copies and prevent the use of an outdated SOP's, only the signed originals are considered "current" and may not be removed from the Workstation Notebooks except by the QA Director. It is the responsibility of each Department Manager to replace or destroy any uncontrolled or outdated photocopies that may be in use within their respective groups.

10.3.2.4. Electronic storage and revision control
All SOP's are stored in MS-Word2000 format at a designated address in the data system. The SOP's stored in these files are security password protected. The QA Director and the Lab Director are the only persons authorized to possess the password, and to modify these files. SOP's in electronic format can be accessed at any appropriately configured workstation in "read only" mode.

10.3.2.5 Schedule for revision
SOP's for analytical procedures in general use are to be reviewed every 12 months. SOP's for critical QC procedures, (QC Limits, Method Detection Limits, Data and Peer Review) are to be updated annually. All other SOP's will be updated as needed, with the objective of updating annually. The President and the QA Director are responsible for ensuring the revision process is implemented.

11.0 CORRECTIVE ACTION PROCESS

An effective Quality Assurance program requires rapid, effective and thorough identification and correction of issues and errors that affect data quality. Timely and effective action minimizes the possibility of producing data of unknown or insufficient quality. The Laboratory Director and the QA Director, with the concurrence of the Department Managers, direct the corrective action when problems that affect product or service quality are identified.

Once a situation has been identified as producing marginal or non-compliant data, the cause of the problem must be identified. Corrective action requires defined responsibilities for scheduling, performing, documenting, and demonstrating the effectiveness of the action. It is the responsibility of the appropriate Department Manager to work with the QA Director to develop a plausible corrective action plan. The plan is tested, if possible, to determine whether the action results in the production of compliant data by eliminating the problem. If the out of control event cannot be resolved samples will be reanalyzed, if possible, with acceptable quality assurance results.

The overall goal of the corrective action process is to identify and permanently correct situations that lead to generation of errors in the measurement process. The documentation component of this process is implemented to record the samples affected by the situation, and as a managerial tool to facilitate correcting the errors in a timely manner.

A Corrective Action Report is used to document corrective action plans and activities. Any member of the C&T staff may initiate corrective action, but the plan itself must involve the QA Director and should involve any affected Department Managers.

Data are not generated in a situation where questions concerning the data quality may exist unless the client has been informed of the situation and has dictated that course of action. The QA Director has the authority and responsibility to require any activities that could compromise or have compromised data quality objectives to be discontinued or limited until corrective action is complete and quality is no longer compromised.

11.1 Corrective Actions for Sample Analyses & Related Activities

For all organic and most inorganic analyses, the LIMS automatically identifies surrogate, spike, and calibration failures. Corrective action must be initiated when blank spike recoveries or %RPD, calibration response factors, sample loss, or other method-specific QC procedures or criteria cannot be met by the analysis. For matrix spikes or duplicates, the LIMS system FAIL notifications and case narratives may serve as corrective action notices.

11.2 Corrective Action Report

If corrective actions can be completed within 48 hours without impacting data quality, a notice need not be initiated, otherwise a Corrective Action Report (CAR) must be initiated within 4 hours of detecting the out of control event. Corrective action reports must be initiated by the analyst, or by the reviewer who identifies the mistake; these reports are then automatically emailed from the LIMS to the Department Manager, Project Manager, QA Director, and Operations Manager. The corrective action notices are serially numbered and available through the LIMS and a copy is filed in the job jacket of the order(s) affected.

11.3 When Sample Analyses Cannot Meet Acceptance Criteria

If corrective action cannot resolve an out of control sample analysis, and results of sample analysis are affected, the Department Manager must notify the Quality Assurance Director. If in the QA Director's judgment, results of sample analysis are affected, a summary of out of control QA procedures must be communicated to the client with the results of the affected analyses. The process outlined below for correcting systems must be initiated.

In many instances, methods and procedures designed for a wide variety of sample matrices do not and/or cannot be completed to meet acceptance criteria. Typical examples of these conditions are matrix effects that prevent the achievement of surrogate recoveries, and matrix spiking accuracy and/or precision criteria. Data reported from testing activities that do not meet acceptance criteria must be flagged, annotated or otherwise qualified to the client receiving the data. Every effort must be made to clearly identify the reason the acceptance criteria could not be met and to report efforts made by C&T to achieve compliant results. Case narratives and flags or footnotes on certificates of analyses are acceptable means of informing clients of analyses that could not be performed to meet established performance criteria.

11.4 Corrective Action for Systemic Errors

C&T has developed and implemented a process to identify and correct recurring errors, and those that arise from system design or implementation processes. It is the QA Director's responsibility to manage and document the process.

1. Identify the problem, and conditions leading to the problem, as briefly and clearly as possible.
2. Identify a responsible person, or team of people, who can be held accountable for the outcome of the corrective action. Select an individual(s) who is responsible and able by authority or ability to achieve the results desired.
3. With the input, feedback and general agreement of the responsible individual or task force, the QA Director will develop a written outline of what lab processes are affected and what actions needs to be taken.
4. Identify all steps which must be taken immediately and proceed with alacrity.
5. Set corrective action goals in writing, with the following criteria addressed:
   Responsible Party: One person who will be responsible for completing the task or realizing the goal
   Timetable: A date when the action will be completed
   Completed Specifications: What a corrected situation looks like.
   Priority: Where does this goal/task fit in with other tasks and responsibilities addressed by the responsible party?

11.5 Filing & Tracking Corrective Actions

The laboratory has established an electronic system for record keeping and documenting the efforts and results of the system of corrective action outlined above. Copies of the completed corrective action forms will be included in the project file for the associated samples and are available through the LIMS.

11.6 Auditing Corrective Actions

The President/ Lab Director will periodically audit corrective action files and efforts. Corrective actions are subject to progress/completion checks during internal audits.

12.0 QUALITY ASSURANCE REPORTING & RECORDS

The QA Director maintains sufficient records to furnish evidence of the day-to-day activities affecting quality in accordance with the requirements of the C&T QA Plan. Based on the results of internal and external audits, the C&T QA Director prepares reports as needed for the Department Managers, Operations Manager, and the Lab Director. Typical QA reports contain:

- Deficiencies and problems identified throughout the period or audit, action items, and results of monitoring efforts.
- Procedural problems that have affected quality results.
- Past due corrective actions, if relevant or applicable.
- Objectives from any previous reports that were not achieved.
- QA/QC objectives for the period.

All QA program records and data files are maintained in a secure manner, insuring that only authorized personnel have access to them. Records are periodically archived in secure third party offsite storage according to procedures that maintain access control, and retrieval.

12.1 Reports to Lab Director

Any major problem that is not easily resolved at the Department Manager level is brought to the attention of the appropriate laboratory management staff for resolution. Any time problems occur on a frequent basis, reports to laboratory management are made weekly or daily, as needed, until the situation is resolved.

12.2 QA Director's Planning and Review Reports

Goal setting and reviews of priorities for personnel responsible for development and implementation of the QA program are important quality management tools. The QA Director is responsible for preparing periodic reports detailing shorter and longer-term goals for the QAP at C&T. These reports are expected to summarize the periodic reports outlined above, report on monitoring results of corrective action plans, and identify and propose solutions to any recurring problems.

12.3 Lab Directors Performance Reviews of QA Director

The Lab Director is expected to produce periodic reports covering the design, development, and implementation of C&T's QAP. The performance reviews of the QA Director and the QAP, particularly the items that relate to the effectiveness of efforts taken by the QA Director to meet his or her responsibilities, is an important component of the QAP at C&T.

These reports can be useful to identify the financial or managerial freedom or limitations and constraints placed on QA Directors in their efforts to implement the QAP. This report is also a review of effectiveness from the individuals with ultimate authority and is a testament, if nothing else, to their involvement with and commitment to the quality improvement process.

12.4 QA Recordkeeping

Documenting the efforts undertaken by C&T staff toward implementing the QAP is a significant undertaking, requiring skills in filing and document retrieval. The QA Director is responsible for filing

documentation supporting the activities related to the QAP. Filing systems for the following reports, documents, events and activities are the responsibility of the QA Director.

- Corrective Actions
- Method validation files
- MDL Studies
- Control Charts and Control Limit determinations
- Standard Operating procedures
- Benchbooks, Run Logs, Instrument Logs and other bound notebooks
- Training files and participation records
- Audits results and follow-up
- Certification applications and approvals

APPENDIX_1: Containers, Preservation & Holding Times

(Client Services SOP 3.1, Rv.4, Effective 12/03/04)

ORGANICS	Matrix	Prep Method	Analytical Method	Holding Time[5]	Minimum Volume	Water Sampling Container	Water Sampling Preservative[7]
TPH/Diesel [3]	Water	EPA 3520	EPA 8015B	14/40 [6]	500 mL	1L G	None
	Soil	CA LUFT[4]	EPA 8015B	14/40 [6]	50 g		
TPH/Gasoline [2]	Water	EPA 5030	EPA 8015B	14 days	40 mL	2 x 40mL VOA	HCL[8]
	Soil	EPA 5030[9]	EPA 8015B	14 days	5 g		
Alcohols (Methanol, Ethanol)	Water	Direct Inject	EPA 8015B	14 days	40 mL	2x40mL VOA	None
Aromatic VOCs (8020 list)	Water	EPA 5030	EPA 8260	14 days	40 mL	2x40mL VOA	HCL[8]
	Soil	EPA 5030[9]	EPA 8260	14 days	5 g		
BTXE [1]	Water	EPA 5030	EPA 8021B	14 days	40 mL	2 x 40mL VOA	HCL[8]
	Soil	EPA 5030[9]	EPA 8021B	14 days	5 g		
Carbon Dioxide (dissolved)	Water	METHOD[4]	RSK-175	14 days	40 mL	2x40mL VOA	None
Creosote, coal tar	Water	EPA 3520	EPA 8270	7/40 [6]	1 L	1L G	None[8]
	Soil	EPA 3550	EPA 8270	14/40 [6]	30 g		
1,4-Dioxane	Water	EPA 3520	EPA 8270-SIM	7/40 [6]	1 L	1L G	None[8]
	Soil	EPA 3550	EPA 8270-SIM	14/40 [6]	30 g		
Dioxins & Furans	Water	METHOD[4]	EPA 8280	30/45 [6]	1 L	1L G	None[8]
	Soil	METHOD[4]	EPA 8280	30/45 [6]	10 g		
Dioxins & Furans (Low Concentration)	Water	METHOD[4]	EPA 8290	30/45 [6]	1 L	1L G	None[8]
	Soil	METHOD[4]	EPA 8290	30/45 [6]	10 g		
Dissolved Gasses (except CO_2)	Water	METHOD[4]	RSK-175	14 days	40 mL	2x40mL VOA	HCL
Dissolved Gasses (CO_2)	Water	METHOD[4]	RSK-175	14 days	40 mL	2x40mL VOA	None
Gasoline Oxygenates	Water	EPA 5030	EPA 8260	14 days	40 mL	2x40mL VOA	HCL[8]
	Soil	EPA 5030[9]	EPA 8260	14 days	5 g		
Halogenated VOCs (8010 list)	Water	EPA 5030	EPA 8260	14 days	40 mL	2x40mL VOA	HCL[8]
	Soil	EPA 5030[9]	EPA 8260	14 days	5 g		
MTBE (Methyl tert-Butyl Ether)	Water	EPA 5030	EPA 8021B	14 days	40 mL	2x40mL VOA	HCL[8]
			EPA 8260B	14 days	40 mL	2x40mL VOA	HCL[8]
	Soil	EPA 5030[9]	EPA 8021B	14 days	5 g		
			EPA 8260B	14 days	5 g		
Nitroaromatics & Nitramines (Explosives)	Water	METHOD[4]	EPA 8330	7/40 [6]	1 L	1L G	None[8]
	Soil	METHOD[4]	EPA 8330	14/40 [6]	10 g		
Organochlorine Herbicides	Water	METHOD[4]	EPA 8151	7/40 [6]	1 L	1L G	None
	Soil	METHOD[4]	EPA 8151	14/40 [6]	30 g		
Organochlorine Pesticides	Water	EPA 3520	EPA 8081A	7/40 [6]	1 L	1L G	None
	Soil	EPA 3550	EPA 8081A	14/40 [6]	30 g		
Pentachlorophenol	Water	EPA 3520	EPA 8270	7/40 [6]	1 L	1L G	None[8]
	Soil	EPA 3550	EPA 8270	14/40 [6]	30 g		
Phenols (including cresols)	Water	EPA 3520	EPA 8270	7/40 [6]	1 L	1L G	None[8]

ORGANICS	Matrix	Prep Method	Analytical Method	Holding Time[5]	Minimum Volume	Water Sampling Container	Water Sampling Preservative[7]
	Soil	EPA 3550	EPA 8270	14/40 [6]	30 g		
Phthalates	Water	EPA 3520	EPA 8270	7/40 [6]	1 L	1L G	None[8]
	Soil	EPA 3550	EPA 8270	14/40 [6]	30 g		
Polychlorinated Biphenyls (PCBs)	Water	EPA 3520	EPA 8082	7/40 [6]	1 L	1L G	None
	Soil	EPA 3550	EPA 8082	14/40 [6]	30 g		
Polynuclear Aromatic Hydrocarbons	Water	EPA 3520	EPA 8270	7/40 [6]	1 L	1L G	None[8]
			EPA 8310	7/40 [6]	1 L	1L G	None[8]
			EPA 8270-SIM	7/40 [6]	1 L	1L G	None[8]
Polynuclear Aromatic Hydrocarbons	Soil	EPA 3550	EPA 8270	14/40 [6]	30 g		
			EPA 8310	14/40 [6]	30 g		
			EPA 8270-SIM	14/40 [6]	30 g		
Semivolatile Organics	Water	EPA 3520	EPA 8270	7/40 [6]	1 L	1L G	None[8]
	Soil	EPA 3550	EPA 8270	14/40 [6]	30 g		
Volatile Organics (8240 list)	Water	EPA 5030	EPA 8260	14 days	40 mL	2x40mL VOA	HCL[8]
	Soil	EPA 5030[9]	EPA 8260	14 days	5 g		
Volatile Organics (extended list)	Water	EPA 5030	EPA 8260	14 days	40 mL	2x40mL VOA	HCL[8]
	Soil	EPA 5030[9]	EPA 8260	14 days	5 g		

ORGANIC COMPOUNDS - NOTES:

1.) Benzene, toluene, ethylbenzene, and xylenes: MTBE (methyl tert-butyl ether) may be added upon request.

2.) Total Petroleum Hydrocarbons as Gasoline: JP-4, mineral spirits, or stoddard solvent may be added upon request. Reporting limits may be higher for fuels other than gasoline.

3.) Total Petroleum Hydrocarbons as Diesel: motor oil, commercial jet fuel, JP-5, hydraulic oil, transformer oil, or Bunker C may be added upon request. Reporting limits may be higher for fuels other than diesel.

4.) CA LUFT: California Department of Health Services Leaking Underground Fuel Tank Manual, October 1989. "Method" indicates that the prep method is an integral part of the analytical method.

5.) Holding times specified in 40CFR 136.3 Table 2 (Clean Water Act/ NPDES) and SW-846 Table 2-36 Revision 3, December 1996.

6.) X/Y: X days from sample collection to extraction, then Y days from extraction to analysis.

7.) Samples should be kept at 4^0C from time of collection until analysis. Preserved containers can be supplied by C&T. HCL: hydrochloric acid to pH < 2, H_2SO_4: sulfuric acid to pH < 2, NaOH: sodium hydroxide to pH > 12

8.) Free chlorine should be neutralized with 0.008% $Na_2S_2O_3$.

9.) Prep method EPA 5035, using Encore sampling devices, may be used in place of EPA 5030; contact lab for details.

LEGEND:

VOA: amber VOA vial

G: amber glass

P: Polyethylene

METALS	Matrix	Prep Method	Analytical Method	Holding Time[5]	Minimum Volume	Water Sampling Container	Water Sampling Preservative[3]
Cations	Water	EPA 3010A	EPA 200.7 or 6010B	6 mo	100 mL	250mL P	HNO_3
	Soil	EPA 3050B	EPA 6010B	6 mo	2 g		
ICP Metals	Water	EPA 3010A	EPA 200.7 or 6010B	6 mo	100 mL	250mL P	HNO_3
	Soil	EPA 3050B	EPA 6010B	6 mo	2 g		
ICP-MS Metals	Water	EPA 200.8	EPA 6020	6 mo	100 mL	250mL P	HNO_3
	Soil	EPA 3050B	EPA 6020	6 mo	2 g		
Hexavalent Chromium	Water	METHOD[1]	EPA 7196A	24 hr	100 mL	500 mL P	None
		METHOD[1]	EPA 7199	24 hr	50 mL	250 mL P	None
	Soil	METHOD[1]	EPA 7196A	30 days	40 g		
Lead	Water	EPA 3010A	EPA 200.7 or 6010B	6 mo	100 mL	250mL P	HNO_3
		EPA 200.8	EPA 6020	6 mo	100 mL	250mL P	HNO_3
	Soil	EPA 3050B	EPA 6010B	6 mo	2 g		
		EPA 3050B	EPA 6020	6 mo	2 g		
Lead in High Volume Air Filters	Air	METHOD[1]	EPA 7420	NS	Varies		
Mercury	Water	METHOD[1]	EPA 7470A	28 days	100 mL	250mL P	HNO_3
	Soil	METHOD[1]	EPA 7471A	28 days	0.5 g		
Organic Lead	Water	CA LUFT[1]	CA LUFT[1]	14 days	100 mL	500mL P	None
	Soil	CA LUFT[1]	CA LUFT[1]	14 days	50 g		
Priority Pollutant Metals	Water	EPA 3010A/ Method[1]	EPA 6010B/7400	6 mo/28d[4]	100 mL	500mL P	HNO_3
		EPA 200.8/ Method[1]	EPA 6020/7400	6 mo/28d[4]	100 mL	500mL P	HNO_3
	Soil	EPA 3050B/ Method[1]	EPA 6010B/7400	6 mo/28d[4]	5 g		
		EPA 3050B/ Method[1]	EPA 6020/7400	6 mo/28d[4]	5 g		
RCRA (8) Metals	Water	EPA 3010A/ Method[1]	EPA 6010/7400	6 mo/28d[4]	100 mL	500mL P	HNO_3
	Soil	EPA 3050B/ Method[1]		6 mo/28d[4]	5 g		
CA Title 26 Metals (CAM 17)	Water	EPA 3010A/ Method[1]	EPA 6010B/ 7400	6 mo/28d[4]	100 mL	500mL P	HNO_3
		EPA 200.8/ Method[1]	EPA 6020/7400	6 mo/28d[4]	100 mL	500mL P	HNO_3
	Soil	EPA 3050B/ Method[1]	EPA 6010B/ 7400	6 mo/28d[4]	5 g		
		EPA 3050B/ Method[1]	EPA 6020/7400	6 mo/28d[4]	5 g		
Tributyl Tin ("Organo-tin")	Water	EPA 3520C	GC/FPD	NS	1 L		
	Soil	EPA 3550B	GC/FPD	NS	10 g	1L P or G	None

LEGEND:
G: amber glass
P: Polyethylene

METALS - NOTES:

1.) "Method" indicates that the prep method is an integral part of the analytical method.
CA LUFT: California Department of Health Services Leaking Underground Fuel Tank Manual, October 1989

2.) Holding times specified in 40CFR 136.3 Table 2 (Clean Water Act/ NPDES) and SW-846 Table 2-36 Revision 3, Dec 1996.

3.) Samples should be kept at 4°C from time of collection until analysis. Preserved containers can be supplied by C&T.
HCL: hydrochloric acid to pH < 2, H_2SO_4: sulfuric acid to pH < 2, NaOH: sodium hydroxide to pH > 12,
HNO_3: nitric acid to pH < 2

4.) 28 day holding time for mercury; 6 month holding time for all other elements.

General Chemistry	Method	Holding Time[8]		Minimum Volume		Water Sampling	
		Water	Soil	Water	Soil	Container	Preservative[9]
Acidity	EPA 305.1	14 days	--	100 mL	--	250mL P	None
Acid Value	AOCS Cd 3a-63	NS[5]	NS[5]	20 g	20 g	50mL G	None
Alkalinity (as $CaCO_3$)	EPA 310.1	14 days	NS[5]	100 mL	--	250mL P	None
Ammonia Nitrogen	EPA 350.3	28 days	--	100 mL	--	250mL P	H_2SO_4
Asbestos	various	NS[5]	NS[5]	1 L	50 g	1L P	None
Bicarbonate Alkalinity	EPA 310.1	14 days	--	100 mL	--	250mL P	None
Bioassay, %survival	NPDES	36 hr	--	5 gallons	--	5gal cube	None
Bioassay, screen	CCR Title 22	36 hr	36 hr	500 mL	200 g	1L G	None
Biochemical Oxygen Demand (BOD)	EPA 405.1	48 hr	--	600 mL	--	1L P	None
BTU (Heating Value)	ASTM D-240	NS[5]	NS[5]	5 g	5 g	50mL G	None
Carbon, Total Organic	EPA 415.2	28 days	28 days	40 mL	25 g	2 x 40mL VOA	H_2SO_4
Carbon, Total Inorganic	EPA 415.2	28 days	--	40 mL	--	2 x 40mL VOA	H_2SO_4
Carbonate Alkalinity	EPA 310.1	NS[5]	--	100 mL	--	250mL P	None
Cation Exchange Capacity	EPA 9081	--	6 mo	--	10 g	--	--
Chemical Oxygen Demand (COD)	EPA 410.4 / SM 5220D	28 days	--	100 mL	--	250mL P	H_2SO_4
COD, Filtered	EPA 410.4	28 days	--	100 mL	--	250mL P	H_2SO_4
Chloride	EPA 300.0	28 days	--	100 mL	--	250mL P	None
Chlorine, Residual	EPA 330.5	in field	--	100 mL	--	250mL G	Foil wrapped
Coliform, Fecal		6 hr	--	100 mL	--	sterile 100mL	$Na_2S_2O_3$
Color	AOCS methods	48 hr	--	50 mL	--	250mL G	None
Conductivity	EPA 120.1	28 days	--	100 mL	--	250mL P	None
Corrosivity to Steel (NACE)	EPA 1110	NS[5]	NS[5]	1 L	1000 g	1L G	None
Chromium, Hexavalent	EPA 7196A	24 hrs	30 days	100 mL	40 g	500mL P	None
Chromium, Hexavalent	EPA 7199	24 hrs	--	50 mL	--	250mL P	None
Cyanide	EPA 335.2 or 9010B/9014	14 days	14 days	500 mL	5 g	500mL P	NaOH
Cyanide, Amenable	EPA 9010B/ 9014	14 days	14 days	500 mL	10 g	500mL P	NaOH
Cyanide, Reactive	SW846 Ch.7	NS[5]	NS[5]	25 mL	10 g	500mL P	None
Density	ASTM or AOCS	NS[5]	--	200 mL	--	250mL P or G	None
Dissolved Oxygen	EPA 360.1	in field	--	100 mL	--	250mL G	None
Dissolved Sulfide	EPA 376.2	7 days	--	50 mL	--	500mL P	NaOH
Ferrous Iron (Fe2+)	SM 3500FeD	in field	--	50 mL	--	100mL P or G	HCL
Ferric Iron (Fe3+)	SM 3500FeD	24 hr	--	see Notes	--	2 x 100mL P	see Notes (6)
Flash Point	EPA 1010	NS[5]	--	60 mL	NA	250mL P	None
Fluoride	EPA 300.0 or 340.2	28 days	28 days	100 mL	10 g	250mL P	None
Free Fatty Acids	AOCS methods	NS[5]	NS[5]	50 mL	50 g	100mL P or G	None
Free Liquids (Paint Filter Test)	EPA 9095	NS[5]	NS[5]	100 mL	50 g	500mL wide	None
Halogens, Total Organic	EPA 9020	28 days	28 days	200 mL	10 g	250mL P or G	H_2SO_4
Hardness, as $CaCO_3$	EPA 130.2	6 mo.	--	100 mL	--	250mL P	HNO_3
Heating Value	ASTM D-240	NS[5]	NS[5]	5 g	5 g	100mL P or G	None
Hexavalent Chromium	EPA 7196A	24 hr	30 days	100 mL	40 g	500mL P	None
Hexavalent Chromium	EPA 7199	24 hrs	--	50 mL	--	250mL P	None

General Chemistry	Method	Holding Time[8]		Minimum Volume		Water Sampling	
		Water	Soil	Water	Soil	Container	Preservative[9]
Ignitability	SW846 Ch.7	--	NS[5]	--	10 g	--	None
Iodine Value	AOCS Cd 1b-87	NS[5]	NS[5]	10 g	10 g	50mL G	None
Iron, Ferrous (Fe2+)	SM 3500FeD	24 hr	--	50 mL	--	100mL P	HCL
Iron, Ferric (Fe3+)	SM 3500FeD	24 hr	--	see Notes	--	2 x 100mL P	see Notes (6)
Moisture	CLP-SOW	--	NS[5]	--	25 g	--	None
Nitrate Nitrogen	EPA 300.0	48 hr	--	100 mL	--	250mL P	None
Nitrite Nitrogen	EPA 300.0	48 hr	--	100 mL	--	250mL P	None
Nitrate/ Nitrite Nitrogen	EPA 300.0	28 days	--	100 mL	--	250mL P	None
Nitrogen, Ammonia	EPA 350.3	28 days	28 days	100 mL	10 g	250mL P	H_2SO_4
Nitrogen, Total Kjeldahl (TKN)	EPA 351.4	28 days	28 days	50 mL	5 g	1L P	H_2SO_4
Oil & Grease, Petroleum (H.E.M.-SG)	EPA 1664A	28 days	--	1 L	--	1L G	HCL
Oil & Grease, Total (H.E.M.)	EPA 1664A	28 days	--	1 L	--	1L G	HCL
Organic Lead	CA LUFT[7]	14 days	14 days	100 mL	50 g	250mL P	None
Oxygen Demand, Biochemical	EPA 405.1	48 hr	--	600 mL	--	1L P	None
Oxygen Demand, Chemical	EPA 410.4 / SM 5220D	28 days	--	100 mL	--	250mL P	H_2SO_4
Oxygen, Dissolved	EPA 360.1	In field	--	100 mL	--	250mL G	None
Paint Filter Test	EPA 9095	NS[5]	NS[5]	100 mL	50 g	500mL wide	None
Perchlorate	EPA 314.0	28 days	--	100 mL	--	250mL P	None
Peroxide Value	AOCS Ja 8-87	NS[5]	NS[5]	5 g	5 g	50mL G	None
PH	EPA 9040B/9045C	24 hr	14 days	100 mL	50 g	250mL P	None
Phenolic Compounds	EPA 420.1	28 days	--	500 mL	--	1L G	H_2SO_4
Phosphate, ortho-	EPA 300.0 or 365.2	48 hr	--	50 mL	--	100mL P	None
Phosphate, Total	EPA 365.2	28 days	28 days	50 mL	10 g	250mL P	H_2SO_4
Reactive Cyanide	SW846 Ch.7	NS[5]	NS[5]	25 mL	10 g	500mL P	None
Reactive Sulfide	SW846 Ch.7	NS[5]	NS[5]	25 mL	10 g	500mL P	None
Residual Chlorine	EPA 330.5	In field	--	50 mL	--	100mL G	None
Resistivity	EPA 120.1	28 days	--	100 mL	--	250mL P	None
Salinity	SM 2520B	NS[5]	--	250 mL	--	250mL G	wax seal
Saponification Value	AOCS Cd 3d-25	NS[5]	NS[5]	5 g	5 g	50mL G	None
Silica	EPA 370.1	28 days	28 days	50 mL	10 g	100mL P	None
Solids, Settleable	EPA 160.5	48 hr	--	1 L	--	1L G	None
Solids, Total Dissolved	EPA 160.1	7 days	--	100 mL	--	250mL G	None
Solids, Total Suspended	EPA 160.2	7 days	--	100 mL	--	250mL G	None
Solids, Total Volatile	SM 2540	7 days	NS[5]	100 mL	50 g	250mL P	None
Specific Gravity	ASTM or AOCS	NS[5]	--	200 mL	--	250mL P or G	None
Sulfate	EPA 300.0	28 days	--	100 mL	--	250mL P	None
Sulfide	EPA 376.2	7 days	--	50 mL	--	500mL P	NaOH + ZnAc
Sulfide, Dissolved	EPA 376.2	7 days	--	50 mL	--	500mL P	NaOH
Sulfide, Reactive	SW846 Ch.7	NS[5]	NS[5]	25 mL	10 g	500mL P	None
Sulfite	EPA 377.1	< 24 hr	--	100 mL	--	500mL P	None
Surfactants	EPA 425.1	48 hr	--	250 mL	--	1L P	None
Sulfur	ASTM methods	6 mo	6 mo	1 g	1 g	50mL G	None
Tannins & Lignins	SM 5550B	NS[5]	--	50 mL	--	100mL P or G	None
Thiosulfate	Chevron Chemical	NS[5]	--	100 mL	--	250mL P	None

General Chemistry	Method	Holding Time[8]		Minimum Volume		Water Sampling	
		Water	Soil	Water	Soil	Container	Preservative[9]
Total Dissolved Solids (TDS)	EPA 160.1	7 days	--	100 mL	--	250mL P	None
Total Fatty Acids	AOCS methods	NS[5]	--	50 mL	50 g	100mL P or G	None
Total Inorganic Carbon	EPA 415.2	28 days	28 days	40 mL	25 g	2 x 40mL VOA	H_2SO_4
Total Organic Carbon (TOC)	EPA 415.2	28 days	--	40 mL	--	2 x 40mL VOA	H_2SO_4
	Walkley-Black	--	28 days	--	25 g	--	None
Total Organic Halogens	EPA 9020B	28 days	28 days	200 mL	10 g	250mL P or G	H_2SO_4
Total Suspended Solids (TSS)	EPA 160.2	7 days	--	100 mL	--	250mL G	None
Total Volatile Solids	SM 2540	7 days	NS[5]	100 mL	50 g	250mL P	None
Tributyl Tin	GC/FPD	NS[5]	NS[5]	1 L	10 g	1L P or G	None
Turbidity	EPA 180.1	48 hr	--	100 mL	--	250mL G	None
Viscosity	ASTM methods	NS[5]	--	25 mL	--	50mL P	None

General Minerals	Method	Holding Time[8]		Minimum Volume		Water Sampling	
		Water	Soil	Water	Soil	Container	Preservative[9]
Alkalinity (as $CaCO_3$)	EPA 310.1	14 days	NS[5]	100 mL	--	250mL P	None
Chloride, Sulfate	EPA 300.0	28 days	--	100 mL	--	250mL P	None
Conductivity	EPA 120.1	28 days	--	100 mL	--	250mL P	None
PH	EPA 9040B/ 9045C	24 hr	14 days	100 mL	--	250mL P	None
Total Dissolved Solids (TDS)	EPA 160.1	7 days	--	100 mL	--	250mL P	None
Ca, Fe, Mg, Na, Zn, Hardness	EPA 200.7 or 6010B	6 mo	6 mo	100 mL	--	250mL P	HNO_3
Optional Analysis (can be added to list):							
Surfactants (MBAS)	EPA 425.1	48 hr	--	250 mL	--	1L P	None

RCI Reactivity, Corrosivity & Ignitability	Method	Holding Time[8]		Minimum Volume		Water Sampling	
		Water	Soil	Water	Soil	Container	Preservative[9]
Reactive Cyanide	SW846 Ch.7	NS[5]	NS[5]	25 mL	10 g	500mL P	None
Reactive Sulfide	SW846 Ch.7	NS[5]	NS[5]	25 mL	10 g	500mL P	None
PH	EPA 9040B/ 9045C	24 hr	14 days	100 mL	50 g	250mL P	None
Ignitability	SW846 Ch.7	--	NS[5]	--	10 g	--	None

Major Cations	Method	Holding Time[8]		Minimum Volume		Water Sampling	
		Water	Soil	Water	Soil	Container	Preservative[9]
Ca, Mg, K, Na	EPA 200.7 or 6010B	6 mo	6 mo	100 mL	--	250mL P	HNO_3

Major Anions	Method	Holding Time[8]		Minimum Volume		Water Sampling	
		Water	Soil	Water	Soil	Container	Preservative
Bicarbonate & Carbonate (Alkalinity)	EPA 310.1	14 days	NS[5]	100 mL	--	250mL P	None
Chloride, Sulfate	EPA 300.0	28 days	--	100 mL	--	250mL P	None

Major Anions	Method	Holding Time[8]		Minimum Volume		Water Sampling	
		Water	Soil	Water	Soil	Container	Preservative

Ion Chromatography	Method	Holding Time[8]		Minimum Volume		Water Sampling	
		Water	Soil	Water	Soil	Container	Preservative[9]
Bromide	EPA 300.0	28 days	NS[5]	100 mL	1 g	250mL P	None
Chloride	EPA 300.0	28 days	NS[5]	100 mL	1 g	250mL P	None
Nitrate-Nitrogen	EPA 300.0	48 hr	NS[5]	100 mL	1 g	250mL P	None
Nitrite-Nitrogen	EPA 300.0	48 hr	NS[5]	100 mL	1 g	250mL P	None
Ortho-Phophate Phosphorous	EPA 300.0	48 hr	NS[5]	50 mL	1 g	250mL P	None
Sulfate	EPA 300.0	28 days	NS[5]	100 mL	1 g	250mL P	None
Hexavalent Chromium	EPA 7199	24 hrs	N/A	50 mL	--	250mL P	None
Perchlorate	EPA 314.0	28 days	N/A	100 mL	--	250mL P	None

NOTES:

5.) NS: No holding time is specified in the regulations for these methods.

6.) Ferric Iron (Fe^{3+}) is the difference between total and ferrous iron.
Requires submission of two polyethylene bottles, one preserved with HCl and one with HNO_3.

7.) CA LUFT: California Department of Health Services Leaking Underground Fuel Tank Manual, October 1989.

8.) Holding times specified in 40CFR 136.3 Table 2 (Clean Water Act/ NPDES) and SW-846 Table 2-36 Rev 3, Dec 1996.

9.) Samples should be kept at 4^0C from time of collection until analysis. Preserved containers can be supplied by C&T.
HCL: hydrochloric acid to pH<2, H_2SO_4: sulfuric acid to pH<2, NaOH: sodium hydroxide to pH > 12, ZnAc: Zinc Acetate.

LEGEND:

mg/L: milligrams per liter
µg/L: micrograms per liter
mg/Kg: milligrams per kilogram
µg/Kg: micrograms per kilogram
VOA: amber VOA vial
G: Glass
P: Polyethylene

APPENDIX_2: C&T Standard Operating Procedures

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VOLATILE ORGANICS: STANDARD OPERATING PROCEDURES

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SEMIVOLATILE ORGANICS: STANDARD OPERATING PROCEDURES

EXTRACTION LAB: STANDARD OPERATING PROCEDURES

SECTION 4: Waste Dilutions and Screening Methods		File Name	Rev#	Effective or Re-Approved
4.1	PCB's in Oil	PCB_OIL	4	10-May-02
4.2	Organochlorine Pesticide Waste	8081_WASTE	3	18-Jun-02
4.3	Medium level extraction for wastes for 8270	EPA3580.EXT	*update in progress*	
4.4	T.E.H by Waste Dilution of Solvents & Waste Oil	TEH_WASTE	1	30-Apr-02

SECTION 5: Sample Cleanup Methods		File Name	Rev#	Effective or Re-Approved
5.1	General Cleanup Notes - Method 3600	SW-846		
5.2	Alumina Column Cleanup - Method 3610	SW-846		
5.3	Alumina Cleanup of Petroleum Waste - Method 3611	SW-846		
5.4	Florisil Column Cleanup - Method 3620	SW-846		
5.5	Silica Gel Column Cleanup - Method 3630	SW-846		
5.6	Automated GPC Cleanup - Method 3640	SW-846		
5.8	GPC Using ABC Model AS2000	GPC_AS2000	5	03-Jul-01
5.9	Florisil Cleanup of Hexane Extracts	EPA3620	2	05-Mar-04
5.10	Sulfur Cleanup - Method 3660	EPA3660	3	15-Dec-01
5.11	Silica Gel Clean-up of TEH Extracts	TEHSG	4	15-Jun-01

SECTION 6: CLP Extraction Methods
Note: All CLP methods have been archived since 1995.

SECTION 7: SPECIAL PROJECTS		File Name	Rev#	Effective or Re-Approved
7.4	PCB Soxhlet Extraction of Wood Chips	PCBSOX.EXT	1	11-Aug-96
7.6	PCB Manchester Extraction	PCB-Manchester	3	03-May-02
7.7	8270-SIM	8270_SIM	0	08-Feb-02
7.8	Organo-Phosphorous Pesticides (OPP) in Water	OPP_W	0	19-Mar-02
7.9	Fitration of Water Samples for TEH	TEH_Filtration	0	*in progress*

SECTION 8: WIPES		File Name	Rev#	Effective Date
8.1	PCBs in Wipe Samples	PCB_WIPE	5	17-May-02
8.3	8081 Organochorine Pesticides in Wipes	8081_WIPE	0	*in progress*
8.4	8270 Semivolatiles in Waste & Oil Samples	8270_WASTE	3	03-Oct-02
8.5	8270 Semivolatiles in Wipe Samples	8270WIPE.EXT	2	11-Aug-96

METALS: STANDARD OPERATING PROCEDURES

	Filename	Rev	Effective or Re-Approved
SECTION 6: GRAPHITE FURNACE AA METHODS			
All GFAA Methods have been archived since 1998			
SECTION 7: FLAME AA METHODS	Filename	Rev	Effective or Re-Approved
7.1 Analysis of Digests & Waters for Lead by FAA	PB_FAA 1	25-JUN-97	
7.2 Determination of Lead in Hi Volume air Filters	PBFLTSOP	0	ARCHIVED
SECTION 8: ORGANOMETALLIC COMPOUNDS			
8.1 Analysis of Organometallics in Oil Samples	DILT&SHT	0	ARCHIVED
8.2 Analysis of Organic Lead in Soil & Water	ORG_PB	2	16 April 04
SECTION 9:	Filename	Rev	Effective or Re-Approved
SECTION 10: MISCELLANEOUS			
10.2 Instrument Detection Limit SOP	IDL	Draft	25-JUN-97

WET CHEMISTRY: STANDARD OPERATING PROCEDURES

4.11	Surfactants (MBAS), EPA 425.1/ 5540C	MBAS	4	06-JUL-2001
4.12.1	Total Organic Carbon (TOC) by EPA 415.2	TOC_415	*update in progress*	
4.12.2	Total Organic Carbon (TOC) by EPA 9060	TOC_9060	*update in progress*	

SECTION 5: MISCELLANEOUS		Filename	Rev	Effective or Re-approved
5.1	Flash Point, EPA 1010	FLASH	5	16-JUL-2002
5.2	Hardness by Calculation, 6010B/2340B	HARDCALC	3	09-JUL-2002
5.3	Ignitability of Solids, ASTM D-93/ EPA 1010	IGNITE	2	15-JUN-1998
5.4	Reactivity, Sulfide & Cyanide, SW846 Ch.7	REACTIVTY	4	09-JUL-2003
5.5	Temperature, EPA 170.1	TEMP	1	15-JUL-1996

SECTION 6: ION CHROMATOGRAPHY		Filename	Rev	Effective or Re-approved
6.1	Anions by EPA 300.0	ANIONS_300	6	08-MAY-2003
6.2	Perchlorate by EPA 314	CLO4	1	12-MAY-2003
6.3	Hexavalent Chromium by EPA 7199	CR6_IC	0	07-MAY-2002

CLIENT SERVICES: STANDARD OPERATING PROCEDURES

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QUALITY ASSURANCE: STANDARD OPERATING PROCEDURES

SECTION 4: Specifications and Corrective Actions	Filename	Rev	Effective or Re-Approved
4.1 Control Limits & Trend Analysis	Control Limits	7	09-FEB-2004
4.2 Corrective Action Procedure	CAR_rv4	*update in progress*	
4.2.1 PE Sample Corrective Actions	CORGUIDE.WPD	2	21-FEB-2002
4.3 Method Development	Method Development	3	10-MAY-2004
4.4 Method Detection Limits	MDL Study	6	20-FEB-2004

SECTION 5: Documentation Procedures	Filename	Rev	Effective or Re-Approved
5.1 Data package organization, submittal storage	DATAPAK	3	04-AUG-2004
5.3 Generating and Updating SOP's	SOP_SOP	5	04-AUG-2004
5.4 Lab Benchbooks, Content & Filing	BENCHBOOK	3	01-SEP-2004
5.5 Electronic Data Storage & Retrieval	ELECTDTA	*moved to Section 9.5*	
5.6.1 QC Data Review by Peer, DM, QC Chemist	DATA REVIEW	4	04-AUG-2004
5.6.2 Procedure & Checklists for QA Data Review	QA_REVIEW	0	04-AUG-2004
5.7 Records Custody for Change of Ownership	Records_Co_Sale	0	04-AUG-2004
5.8 Updating the Laboratory QA Manual	QAM_Updates	0	04-AUG-2004

SECTION 6: Staff Training and Development	Filename	Rev.	Effective or Re-Approved
6.1 Commonly used Calculations	EQUATIONS	2	04-AUG-2004
6.2 Workstation Training Analyst Proficiency	TRAIN	3	04-AUG-2004
6.3 Training Checklists			
6.3.1 Training Checklist – Organics	ORGANICS.xls	3	04-AUG-2004
6.3.2 Training Checklist – Metals	METALS.xls	3	04-AUG-2004
6.3.3 Training Checklist – Wet Chem	WETCHEM.XLS	3	04-AUG-2004
6.4 Job Descriptions			
6.4.1 Analyst	an_desc	3	05-JAN-2004
6.4.2 Project Manager	proj_mgr	2	07-JAN-2004
6.4.3.1 Group Leader	gl_desc	4	05-JAN-2004
6.4.3.2 Deptarment Manager	deptmgr_desc	4	05-JAN-2004
6.4.4 Quality Assurance Director	qad_desc	1	30-SEP-2003
6.4.5 Operations Manager	ops_mgr	0	30-SEP-2003
6.4.6 Support Technician	suppt_desc	2	04-AUG-2004
6.4.7 Lab Diector	lab_dir	2	30-SEP-2003
6.4.8 QC Chemist	qc_chemist	2	23-AUG-2004
6.5 Performance Appraisals			
6.5.1.1 Analyst Self Assessment	AN_SELF	2	01-OCT-2004
6.5.1.2 Analyst Performance Appraisal	AN_PERFORMANCE	3	01-OCT-2004
6.5.1.3 Analyst Peer Assessment	AN_PEER	2	01-OCT-2004
6.5.2.1 Project Manager Self Assessment	PM_SELF	2	01-OCT-2004
6.5.2.2 Project Manager Performance	PM_PERFORMANCE	2	01-OCT-2004
6.5.2.3 Project Manager Peer Assessment	PM_PEER	2	01-OCT-2004
6.5.3.1 Group Leader Self Assessment	GL_SELF	2	27-JUL-2004
6.5.3.2 Group Leader Performance Appraisal	GL_PERFORMANCE	3	09-JAN-2004
6.5.3.3 Department Mgr Performance	DM_PERFORMANCE	3	05-JAN-2004
6.5.6.1 Support Technician Self Assessment	SUPPT_SELF	0	04-AUG-2004
6.5.6.2 Support Technician Performance	SUPPT_PERFORMANCE	0	05-JAN-2004
6.5.7.2 Extraction Chemist Performance	XLAB_PERFORMANCE	0	07-JAN-2004
6.5.8.2 QC Chemist Performance	QCCHEM_PERFORM	0	01-OCT-2004

SECTION 7: Miscellaneous Procedures	Filename	Rev.	Effective or Re-Approved
7.1 Dishwashing Procedures	DISHWASH	3	01-AUG-2000
7.2 Inorganic Dishwashing	DISH_INORGANICS	5	27-OCT-2003
7.3 Dilution and Documentation and DF Conventions	DILUTNS	1	01-AUG-2000
7.5 Reprocessing Chromatographic Data Files	REPROCES	1	16-APR-2002
7.6 Purchasing Consumables	CONSUMABLES	0	25-JUL-2002

SECTION 8: References,

8.1	40 CFR Contents	40CFR	0	13-FEB-2004
8.1	Glossary	DOD QSM App.B	2	29-JUN-2000
8.3	Superfund Glossary	NUS Corporation		1986

SECTION 9: Database Systems

		Filename	Rev.	Effective or Re-Approved
9.1	LIMS Data Security	LIMS Data Security	4	10-JAN-2003
9.2	LIMS Software Development	LIMS Development	4	19-DEC-2003
9.3	LIMS Software Maintenance	LIMS Maintenance	3	19-DEC-2003
9.4	Instrument Data Processing	Instrument Data	0	28-JUN-2002
9.5	Archiving & Retreival	Archiving	0	21-Oct-2002
9.6	Insuring Compliant Manual Integration	Integration	5	13-FEB-2004

APPENDIX_3: MAJOR EQUIPMENT LIST

Curtis & Tompkins, Ltd.
November 12, 2004

Semivolatile Organics	Total #	Instrument Model & Serial #	Autosampler Model & Serial #	Detector Model & Serial #	In Service	C&T ID
GC-FID	4	HP 5890A S/N 3115A34675	HP 7673, S/N 3120A28026		<Feb.95	GC-11
		HP 5890A, S/N 3140A38570	HP 7673, S/N 3237A32122		<Feb.95	GC-13
		HP 5890E, S/N 3336A56636	HP 7673, S/N 3114A25627		<Feb.95	GC-15
		HP 5890A, S/N 3033A30233	HP 7673, S/N 3207A29781		Feb.02	GC-17
GC w/ Dual FID	1	HP 5890E, S/N 3336A51743	HP 7673, S/N 3120A28387		Dec.01	GC-20
GC w/ Headspace TCD/FID	1	Agilent 6890N, CN10414063	Gerstel CTC, S/N 124567		Oct.04	GC-24
GC w/ Dual ECD	6	HP 5890A, S/N 2843A20040	HP 7673A, S/N 2704A09401	HP 19233, S/N F1745 HP 19233, S/N L3548	Oct.90	GC-06
		HP 5890E, S/N 3336A56635	HP 7673, S/N 3442A40499	HP G1223A, S/N K0437 HP G1223A, S/N F4849	Apr.92	GC-14
		HP 5890A, S/N 3235A43989	HP 7673, S/N 3442A40503	HP G1223A, S/N F4791 HP G1223A, S/N F4833	Jun.97	GC-16
		Varian CP-2800, S/N 08829	Varian CP-8400, S/N 01089	ECD S/N A13414 ECD S/N A13413	Jul.02	GC-21
		Varian CP-3800, S/N 10300	Varian CP-8400, S/N 01820	V 02-001972-00/A13872 V 02-001972-00/A13873	Jun.03	GC-22
		Varian CP-3800, S/N 11251	Varian CP-8400, S/N 01703	V 02-001972-00/A14313 V 02-001972-00/A14314	Jun.04	GC-23
HPLC/ UV-VIS & Fluorescence	3	HP 1090, S/N 3016A02811		HP 1046A, S/N 3137G02120	Apr.94	HPLC-01
		HP 1090, S/N 2822A02025		HP 1046A, S/N 3137G02448	Feb.99	HPLC-02
		HP 1090, S/N 3332A04247		integrated into 1090	Sep.03	HPLC-03
SVOC - GCMS	6	HP 5890, S/N 3140A38163	HP 7673, S/N 3114A25622	HP 5971, S/N 3118A02337	Feb.89	BNA01
		HP 5890, S/N 3121A35677	HP 7673, S/N 3120A26239	HP 5971, S/N 3188A02950	Aug.91	BNA02
		HP 6890, S/N US00011320	HP 7673, S/N 3120A28395	HP 6890, S/N US80110918	Jun.97	BNA03
		HP 5890, S/N 3336A56592	HP 7673, S/N 3441A36905	HP 5972, A/N 3435A01840	Jul.00	BNA04
		HP 6890N, S/N US10233076	HP 7683, S/N CN23226594	HP 5973N, S/N US21843716	Oct.02	BNA[illegible]
		HP 6890N, S/N CN10335028	HP 7683, S/N CN33332145	HP 5973, S/N US33246067	Nov.03	BNA[illegible]
Accelerated Solvent Extractor	1	Dionex ASE-200, 03070482			Oct.03	ASE[illegible]00
GPC	2	OI AP1000, S/N 123 10593			Jan.97	GPC[illegible]
		J2 AccuPrep, 04E-1109-3.1	S/N 4418A2317		Jul.04	GPC04

Volatile Organics	Total #	Instrument Model & Serial #	Autosampler Model & Serial #	Detector Model & Serial #	In Service	C&T ID
FID/ dual PID GC	5	HP 5890A, S/N 3336A54137	Tekmar SolaTek-72, US02218011 Tekmar 3011, US02221018		Oct.88	GC-04
		HP 5890A, S/N 2607A07244	EST Archon 8100, S/N 13972 EST Encon, S/N 278061303P/E		May-90	GC-05
		HP 5890A, S/N 2938A24861	OI Archon 4552, S/N 13245 OI 4560, S/N M951460698		Sep.91	GC-07
		HP 5890A, S/N 3336A56667	Dynatech/Dynatrap, S/N 12339-394		Jan.01	GC-18
		HP 5890A, S/N 3133A37270	Dynatech/Dynatrap, S/N 11562-794		May 98	GC-19
VOC - GCMS	9	HP 5890, S/N 2750A16308	Dynatech/Dynatrap, S/N 1159-593	HP 5972A, S/N 3501A02581	Apr.91	VOA-02
		HP 5890, S/N 2950A27368	Dynatech/Dynatrap, S/N 11474-494	HP 5970, S/N 2824A11265	Aug.92	VOA-03
		HP 5890, S/N 3235A46191	EST Archon 8100, S/N 14025 Encon P&T, S/N 314100803P	HP 5972, S/N 3251A00061	Dec.94	VOA-04
		HP 6890, S/N US00001296	Dynatech/Dynatrap, S/N 11420-294	HP 6890, S/N 00001296	Aug.96	VOA-05
		HP 5890, S/N 2950A27174	Tekmar SolaTek, US01228004 Tekmar 3011, S/N US01248008	HP 5972, S/N 3341A01178	Feb.99	VOA-06
		HP 6890, S/N US00034530	Dynatech/Dynatrap, S/N 11228-793	HP 5973, S/N 94260135	Jun.00	VOA-07
		HP 6890, S/N US00006731	Tekmar AquaTek-70, S/N 190M0421 Tekmar 3100, S/N 01039005	HP 5972, S/N 3251A00069	Mar.01	VOA-08
		HP 5890, S/N 3235A58416	Tekmar AquaTek-70, S/N 02064001 Tekmar 3100, S/N 02056029	HP5972, S/N 3341A01348	Jun.02	VOA-09
		HP 5890E, S/N 3336A9270	Tekmar AquaTek-70, US02214002 Tekmar 3100, US02247016	HP5972A, S/N 3501A02458	Nov.02	VOA-10
VOC Screener w/ Dual FID		HP 6890, S/N US00030201	HP 7683, S/N US02914395 HP 7683, S/N US91506551	HP FID, no serial number HP FID, no serial number	May.01	Screener

Metals	Total #	Instrument Model & Serial #	Autosampler Model & Serial #	Detector Model & Serial #	In Service	C&T ID
Cold Vapor/ Flame AA	1	TJA 4000, S/N 8306			Jun.92	MET-02
CVAA Mercury Analyzer	2	CETAC M6000A, A/N 039920A5X			Mar.00	MET-03
		LeemanHydra AA 112-0064-1/2003			Mar.02	MET-04
Vertical ICP Spectrometer	1	TJA 61, S/N 91882			Oct.88	MET-01
Trace ICP Spectrometer	1	TJA 61E/Trace, S/N 327490	TJA AS-300, S/N D2398		Aug.95	MET-07
Radial/Axial ICP Spectrometer	1	PE 4300DV, 077N4022801			Oct.04	MET-08
ICP-MS	1	Agilent 4500, Model G3152A S/N JP93200208			May.01	MET-05

General Chemistry	Total #	Instrument Model & Serial #	Autosampler Model & Serial #	Detector Model & Serial #	In Service	C&T ID
UV-Vis Spectrophotometer	2	HP 8452A, S/N 2610A01005			<Aug.92	UV
		Spectronics 21, S/N 3110239018				SPEC21
Conductivity Meter	2	Corning M-90, S/N B12443			Mar.97	EC
		Fisher "Traceable", S/N B12443			Feb.02	EC2
Dissolved Oxygen Meter	1	Orion 290A, S/N 004653			Mar.97	DO
Ion Chromatograph	3	Dionex DX-120, S/N 98040436	Dionex AS-40, S/N 98040181	AD 25, S/N 01060374	Jan.00	IC01
		Dionex DX-320, S/N 01070420	Dionex AS-50, S/N 01060456	AD 25, S/N 00121073	Nov.01	IC02
		Dionex DX-120, S/N 03020263	Dionex AS-40, S/N 03030608	DS4-1, S/N 03010789	Apr.03	IC03
Ion Selective Electrode	1	Orion 940, S/N R064A			Nov.97	ISE
Organic Carbon Analyzer	1	Tekmar Phoenix 8000 US03085005			Apr.03	TOC2
pH Meter	1	Orion 420A, S/N 039116			Sep.00	Orion-420
Turbidimeter	1	HF Scientific DRT-100B, S/N 22483			Mar.97	TB
Midi-Distillation System	1	Andrews 110-10-R, S/N AIZ0301			Sep.01	Midi

Data Systems	Total #	
GC/MS and Chromatography	8	HP/ Chemserver
SVOC Chemserver Data System	1	HP/ Unix
Chromatography	16	PE-Nelson/ Turbochrome
	1	HP/ Chemstation
	1	Dionex/ Peaknet
Laboratory IMS	32	C&T Sun/ Oracle
PC-LAN network	32	Novell/ Windows NT - Yossarian

Note: List does not include support equipment (thermometers, digestion blocks, balances, etc.)

APPENDIX_4: C&T Laboratory Personnel

Name/ Title	Organics/ Metals Sample Prep	Organic Analysis by GC	Organic Analysis by GCMS	Organic Analysis by HPLC	Inorganic Analyses by IC	Inorganic Analysis by AA/ AE	General Chemical Analyses	Sample Management	Project Management	Laboratory Management	LIMS/Data Management	QA/ QC Training	Degreed (BS or BA)	Advanced Degree	Years Experience (Sep.03)
Bruce Godfrey - Lab Director/President	x	x	x	x	x				x	x	x	x	x	x	25
John Goyette - Operations Manager	x							x	x	x	x	x	x		17
Teresa Morrison - QA Director	x	x	x	x	x		x	x	x	x	x	x	x		17
Dennis Dougherty - Inorganics Manager	x				x	x	x			x		x	x		20
Robert Hopeman - GC/HPLC Manager	x	x		x	x		x	x		x	x	x	x		12
Steve Stanley - Client Services Mgr	x	x				x	x	x	x	x	x	x	x		20
Terry Walsh - GC/MS Manager	x		x							x	x	x	x		13
Chris Katayanagi - Information Mgmt	x	x	x	x						x	x	x	x		13
David McNerney - Information Mgmt			x								x	x	x		11
Mary Hart - QC Chemist	x	x						x	x			x	x	x	15
Anne Kathain - QC Chemist		x	x									x	x		5
Carol Wortham - QC Chemist	x	x	x				x	x	x	x		x	x		14
Tracy Babjar - Project Manager	x	x				x	x	x	x			x	x		11
Lisa Brooker - Project Manager	x	x	x						x			x			5
Patricia Flynn - Project Manager								x	x			x	x		9
Anna Pajarillo - Projet Manager	x	x		x				x	x	x		x	x		11
Troy Windsor - Sample Control	x	x						x		x		x			12
Peter Petricka - Sample Control								x				x	x		1
Aaron Greiner - Shipping/ Bottle Prep								x				x			1
Adam Abatzis - Chemist		x	x									x	x		3
Zia Ahmad - Chemist	x											x	x		6
Fisseha Alemayehu - Chemist	x	x					x					x	x		3
Matt Bacinskas - Chemist	x	x					x					x	x		2
Brook Buswell - Chemist	x											x	x		1
Kristen Carlyon - Chemist	x	x	x			x	x	x	x	x		x	x		11
Michelle Curtis - Chemist	x											x	x		0
Stefan D'Angona - Chemist	x	x		x	x					x		x	x		4
Jennifer Dell - Chemist	x											x	x		1
Kevin Gaines - Analyst	x						x					x			0
Liza Hernandez - Chemist	x	x	x									x	x		11
Sharon Karagozlu - Chemist	x											x	x		1
Stephen Koster - Chemist	x			x						x		x	x		5
Clarence Lee - Chemist	x	x	x	x	x							x	x		6
Rodelio Manuel - Chemist	x						x					x	x		1
Junn Masongsong - Chemist	x	x										x	x		1
Dennis McCanna - Chemist	x	x			x		x			x		x	x		37
Edward McCaskey - Chemist	x		x	x						x		x	x		21
Jessie O'Brien Mee - Chemist	x											x	x		0
Blair Okuma - Chemist	x	x	x		x					x		x	x		5

Name/ Title	Organics/ Metals Sample Prep	Organic Analysis by GC	Organic Analysis by GCMS	Organic Analysis by HPLC	Inorganic Analyses by IC	Inorganic Analysis by AA/ AE	General Chemical Analyses	Sample Management	Project Management	Laboratory Management	LIMS/Data Management	QA/ QC Training	Degreed (BS or BA)	Advanced Degree	Years Experience (Sep.03)
Vania Ouzounova - Chemist		x					x					x	x		16
Parwinder Pal Singh - Chemist						x	x					x	x	x	7
Adam Pereira - Analyst	x	x										x			3
Micaela Perpetuo - Chemist	x	x								x		x	x		3
Jason Poulton - Chemist	x	x			x		x					x			4
Gabriel Prindle - Chemist	x	x										x	x		7
Joan Protasio - Chemist		x										x	x		0
Kevin Riley - Chemist	x											x			2
Jason Scott - Analyst	x	x										x			3
Radia Shiffa - Chemist							x					x	x		5
Amy Silverberg - Chemist	x	x	X									x	x		1
Micah Smith - Chemist	x	x		x	x		x					x	x		4
Jason Spence - Chemist							x					x	x		0
Morris Tran - Chemist	x	x					x	x				x	x		11
Brian Van Deren - Chemist			x									x	x		4
Thelma Vergara - Analyst	x	x										x			5
Victor Vergara - Technician	x											x			6
Donnel Ward - Chemist	x	x					x			X		x	x		3
Coral Weese - Chemist	x											x	x		1
Lara Wheeling - Chemist	x	x	x									x	x		10
Mei Wu - Chemist	x					x	x					x	x		20

APPENDIX C-2

QUALITY ASSURANCE MANUAL-NORTH COAST LABORATORIES

NORTH COAST LABORATORIES LTD.

QUALITY ASSURANCE MANUAL

North Coast Laboratories, Ltd.
5680 West End Road
Arcata, CA 95521

Phone: 707-822-4649 Fax: 707-822-6831
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2005-Version 1
Effective April, 2005

Approved By:

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Quality Assurance Officer

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Laboratory Manager

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Laboratory and Technical Director

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TABLE OF CONTENTS

PURPOSE OF THIS MANUAL

This manual includes the policies, procedures, responsibilities, and qualifications that comprise NCL's Quality Assurance program. It describes the implementation of the Quality Assurance Program and is designed to meet the requirements of the California Environmental Laboratory Accreditation Program (ELAP), the Colorado Department of Public Health and Environment's Laboratory Services Division, and the regulatory requirements of NCL's clients.

This manual is meant to provide a general overview of the Quality Assurance Program at NCL. Specific details may be found in the Standard Operating Procedures that NCL employees are required to follow. Project-specific requirements may supercede the policies set forth in this manual.

The QA Officer is responsible for keeping this manual current and for its review on an annual basis.

SCOPE OF QA PROGRAM

A QA Program is a system designed to ensure that all data produced and results reported by an analytical procedure are technically sound, statistically valid, and properly documented. QA objectives are set by NCL to produce data of known accuracy, precision, comparability, and completeness. A definition of these terms is presented below.

> Accuracy: Accuracy is a measurement of how close an analytical result is to the true or known value.
>
> Precision: Precision is the degree to which analytical results are reproducible.
>
> Comparability: Comparability expresses the confidence with which similar analytical runs can be compared. Comparability is assured through the use of approved, well documented analytical methods, reporting results in a consistent manner such as on a volume or wet weight basis, and expressing units for particular analytical methods in a consistent manner.
>
> Completeness: Completeness is a measure of the amount of valid data obtained from an analytical system compared to the amount that should have been obtained according to program goals. An example of 100% completeness is if 20 samples are submitted for analysis, there are complete results for all 20 samples.

The following elements are the key components of the Quality Assurance Program:

- documentation procedures which provide current information concerning laboratory capabilities and qualifications for performing specific analyses;

- batch of samples and every matrix analyzed;

- a system of internal and external performance evaluations and audits which validate the analytical performance of the laboratory and the laboratory's compliance with methods and standard operating procedures (SOPs);

- reporting procedures that supply the client with the necessary information to assess the quality of the data;

- documentation procedures that allow for traceability of measurements and reconstruction of data generation.

MISSION STATEMENT

NCL's mission is to provide legally defensible and scientifically sound analytical results to the environmental community at a competitive price. NCL's philosophy is to operate every aspect of the business ethically, with integrity and respect for others. NCL is committed to meeting the analytical requirements of our clients and to provide service that exceeds client expectations.

MANAGEMENT COMMITMENT TO QUALITY ASSURANCE

NCL's management is committed to maintaining a quality assurance program that ensures the integrity, legal defensibility, and regulatory compliance of all data produced by NCL. It is management's goal to maintain a system that is thorough, comprehensive, and implemented effectively by employees.

ETHICS

A sound quality assurance system can only exist in an ethical environment. Expectations for high ethical standards are conveyed to employees from the start of their employment. All employees must sign an ethics agreement (see Exhibit A) when they start work and yearly thereafter. Ethics training is provided by the Quality Assurance Unit (QAU). Typical ethics training includes a group discussion of potential scenarios and a presentation of illegal, improper, and unethical practices. As stated above, employees are also required to sign NCL's Ethics and Data Integrity Agreement following their annual training.

ORGANIZATIONAL STRUCTURE AND RESPONSIBILITIES

NCL is a privately held company, with one location in Arcata, California. NCL is organized into the following functional divisions: the Laboratory Support Services Division, Laboratory Analytical Division and the GLP Studies Division. The Lab Support Division includes the Client Services, Sample Control, IS, and Environmental Health and Safety sections. The Lab Analytical Division includes the Inorganic and the Organic Laboratories. The GLP Studies Division includes the

Analytical, Method Development and Study Management sections. The Quality Assurance Unit reports directly to the Laboratory Manager. An overview of NCL organization is presented in the Organizational Chart (see Appendix B).

The Quality Assurance Program also requires that each laboratory staff member has clearly defined responsibilities. Each employee of NCL is provided with a written job description that defines the responsibilities of their position. Curriculum vitae are maintained and updated annually for all employees who have worked at the laboratory for six months or more. Summaries of the job descriptions are presented below.

Laboratory Director/Technical Director

The Laboratory Director is responsible for all aspects of the laboratory. These responsibilities include analytical capabilities and laboratory performance; instrument maintenance and upgrades; promotion and training of employees; client service; quality assurance; environmental health and safety, and financial stability.

Laboratory Manager

The Laboratory Manager is responsible for implementing programs and procedures which have been designed to meet the goals of the corporation. The Manager shares in the responsibilities of the Laboratory Director and oversees the Quality Assurance Program and the day-to-day operation of the laboratory. The Laboratory Manager reports to the Laboratory Director.

Quality Assurance Unit

The Quality Assurance Officer and assistant(s) are responsible for maintaining and improving the QA program at NCL. Specific duties include: revising the Quality Assurance Manual; following statistical procedures to establish and maintain control limits; conducting facility and internal audits; overseeing performance evaluation samples; writing and updating QA standard operating procedures; designing and implementing a system of in-house blinds and spikes to test method performance; maintaining laboratory certifications; maintaining personnel training files, original SOPs, original methods, malfunction reports and data archives; hosting outside auditors; reviewing analytical reports, and making appropriate recommendations for improvement as necessary.

NCL has a QAU that is entirely independent and separate from personnel engaged in the daily operations of the laboratory.

Technical Staff

Laboratory Supervisors

There are two laboratory supervisors at NCL – an Organic Lab Supervisor and an Inorganic Lab Supervisor. These supervisors report to the Laboratory Manager. The responsibilities of these individuals include supervising the daily activities of each laboratory; scheduling analyses; ensuring that QC samples and QA activities are performed according to Standard Operating Procedures; reviewing data; overseeing instrument maintenance and repair; reviewing and updating department-specific methods and SOPs; training employees, and interfacing with the Laboratory/Technical Director regarding technical issues.

Chemists

Chemists are responsible for performing sample preparations and analyses following established SOP's; performing instrument calibrations and calibration verifications; documenting instrument maintenance; reporting exceptions through the use of Malfunction Reports; performing corrective actions; assisting with peer review of data; meeting quality control requirements as defined in this document.

Sample Custodian

The Sample Custodian is responsible for maintaining chain-of-custody procedures that are delineated in SOPs; for the proper receipt and preservation of samples; for logging samples into the LIMS; for alerting the lab supervisors when samples with short holding times are received and for ensuring that samples are properly stored.

KEY PERSONNEL

Position(s)	Name	Degree(s), Institution (s), Year	Years at NCL
Laboratory Director/Technical Director/President	Jesse G. Chaney	AS Civil Engineering, Monterey Peninsula Junior College,1966; BA Biology, Zoology, and Botany, Humboldt State University, 1972; MS Plant Physiology, Humboldt State University, 1975	26
Vice-President/Consultant/ Study Director/Principal Scientific Investigator	Paige Noon	BA Sociology, Dickinson College, 1970; MS Molecular Biology, State University of New York, 1974	24
Laboratory Manager	Roxanne Golich-Moore	BS Chemistry, Humboldt State University, 1987	18
QA Officer	Laura Miller	BA Political Science, Newcomb College, 1983	20
Lab Supervisor – Organics	Steven Ditto	BS Forestry, Humboldt State University, 1989	18
Lab Supervisor - Inorganics	Robert Stuart	BA Earth Science,UC Santa Cruz, 1975	15
Sample Custodian	Kelley Thompson	BS Agribusiness, California Polytechnic State University, 1992	8

FACILITIES

North Coast Laboratories is presently housed in a custom designed 9200 square foot building. The main building is protected by a constantly monitored fire and burglar alarm system. The facility houses the following units:

- Sample Control Center
- Computer Center; consisting of two NT servers, one mail server, and Ethernet hubs
- Managerial offices
- Walk-in coolers and freezers for sample storage
- Organics Extraction Laboratory
- Gas Chromatography/Liquid Chromatography Instrument Room
- Liquid Chromatography-Mass Spectroscopy/Mass Spectroscopy Laboratory
- Purgeables Laboratory
- Wet Chemistry Laboratory
- Atomic Absorption/ICAP Instrument Room
- Fish Bioassay Laboratory
- Bacteriology Laboratory
- Controlled access data archive room
- Annex which houses a preparation area for volatile organics sampling containers, the shipping and receiving office, and storage rooms.

PERSONNEL TRAINING

All employees of North Coast Laboratories must be qualified for the activities they perform. Employees are hired based on their educational background and work experience. Training records for each employee are maintained by the Quality Assurance Unit (QAU). NCL's training program includes the following elements: Quality Assurance and Ethics, Health and Safety, Network and LIMS Introduction, Technical and Job-specific training, and Demonstrations of Capability. SOP TR 001 provides a general overview of the training requirements for each employee of North Coast Laboratories. SOP SA 001 outlines the Health and Safety Training for all NCL employees.

Quality Assurance Orientation

The QAU provides each new employee with a QA Orientation shortly after he or she is hired. The orientation typically includes the following topics:

- The QA Manual;
- SOP's, NCL methods, and published methods;
- Introduction to Malfunction Reports and corrective action procedures;
- Personnel training files;
- Reporting Raw Data (SOP LA 009);
- Ethics and Confidentiality.

All employees receive QA and ethics refresher training on an annual basis.

Health and Safety

Each new employee is given a copy of the "NCL Code of Safe Practices" by the Safety Officer on his or her first day of employment. This document is read and signed immediately. The signed document is then placed in the personnel files maintained by the QAU. The employee is also given a copy of the NCL Safety Manual and is required to read the document. The new employee is taken on an extensive tour of the facility within the first two weeks of employment. The tour familiarizes the new employee with the location of all safety equipment. High safety standards are maintained through periodic presentations, training, and drills.

Network and LIMS Introduction

Each new user will receive a workstation, e-mail, and LIMS account that is password protected. The permission structure for each user is based on his or her job description. Basic tasks, such as logging on to workstations, viewing e-mail, and accessing various applications will be discussed.

Technical and Job Specific Training

Lists of required SOPs for employees in each department are maintained and given to new employees when hired. The employee's supervisor, (or the supervisor's appointee), is directly involved in all training procedures. A test certification checklist is used to ensure that training is consistent and comprehensive.

NCL conducts periodic training sessions to ensure that employees remain current on laboratory regulatory requirements and job-related information (e.g. QA and Ethics lectures, findings from external inspections and audits). NCL regularly sends employees to training courses and classes offered by equipment manufacturers, chemical societies, and quality assurance societies. The record of all in-house lectures attended and certificates of completion of job-related courses are also maintained in the QAU personnel files.

Demonstration of Capability

An analyst’s Initial Demonstration of Capability (IDOC) is usually achieved through the preparation and/or analysis of four replicate fortifications. The accuracy and precision for the replicates must fall within the lab’s established acceptance limits or, if there are no established limits, then EPA default limits. A MDL study with acceptable accuracy and precision is another means of satisfying this requirement. If all parameters meet the acceptance criteria, the analysis of actual samples may begin. When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to 1) or 2) below.

1. Locate and correct the source of the problem and repeat the test for all parameters of interest.
2. Repeat the test for all parameters that failed to meet criteria. Repeated failure,

however, will confirm a general problem with the measurement system and further investigation is required.

All chemists must demonstrate continued proficiency for each method for which they have been trained by one of the following means:

- Acceptable performance of a blind sample;
- A second demonstration of capability;
- Successful analysis of a blind performance sample on a similar test method using the same technology;
- At least four consecutive laboratory control samples with acceptable levels of precision and accuracy.

SAMPLING PROCEDURES

On-site sampling by NCL is performed on a limited basis. In the event a NCL employee collects samples, client sampling plans are followed. NCL can assist in sample collection by providing the client with sample containers that are properly cleaned and preserved. Appropriate containers, preservatives, and holding times are listed in Appendix K. A Sampling Plan should include the following:

- Selection of appropriate sampling locations, depths, etc.
- Provision for a statistically sufficient number of sampling sites.
- Determination of climatic, and other conditions under which sampling may be carried out.
- Determination of appropriate sampling media (water, soil sediment, wastewater, effluent, etc.).
- Determination of appropriate analytes.
- Selection of appropriate sample containers.
- Selection of frequency of sampling and length of the sampling period.
- Selection of types of samples to be collected. (composites, grabs samples, etc.).
- Selection of appropriate sample preservation procedures.
- Provisions for chain of custody procedures.

SAMPLE CUSTODY AND TRACKING

When a sample enters the laboratory it proceeds through an orderly chain of custody and sample tracking sequence which is designed to ensure the integrity of the sample from the time of its receipt to its final disposition. Each sample is received by the sample custodian and is immediately checked for damage, custody seals, label identification, chain of custody, analyses requested, use of proper containers, proper temperature, the need for preservation, and required holding times. Any discrepancies found are reported to the client. The Sample Custodian preserves samples as required, checks the pH of pre-preserved samples, and notifies laboratory supervisors when samples with short holding times are received. Preservation date and the initials of the preserver are noted on a preservation form that is kept with the chain of custody.

NCL maintains sample custody by keeping the laboratory facility locked and secured. Immediately

after receipt, samples are stored in designated refrigeration or freezer units. Samples are organized in these units by the date they are received. Sample chain of custody documents are signed and dated by the sample custodian when the samples arrive. The chain of custody is filed in the Sample Control area with the client's work order. After inspection, each sample container is assigned a unique computer generated NCL sample identification number. The NCL identification number ensures the anonymity of the client and permits status tracking by the LIMS. This number is also affixed to the sample container.

Unused samples are stored in sample archives, by the date completed, for 60 days after the final report is mailed to the client. Contaminated samples become part of the hazardous waste stream and are processed accordingly. Non-contaminated samples are disposed of according to local and state regulations.

REVIEW OF WORKLOAD

At any one time a laboratory's work load can range from standard analyses to special projects that may demand a great deal of the lab's resources. To ensure that the objectives of a project are met, pre-intake arrangements that include items such as a Quality Assurance Project Plan (QAPP), sampling and analysis plans, laboratory certification requirements, and electronic reporting requirements are of the utmost importance. At NCL, a Client Services Representative (CSR) interfaces with clients and takes the proposed project specifications to the Laboratory Manager and the laboratory supervisors. The laboratory supervisors determine laboratory capacity and the resources necessary to successfully complete the project. The Laboratory Manager approves purchases and hires or re-assigns employees to ensure that the project will be completed on time and meets the data quality objectives of the client. Once the project begins, a Project Manager may take over as the interface between the laboratory and the client.

PROJECT MANAGEMENT

The Project Manager's responsibilities are as follows:

- Placing bottle orders and scheduling sample deliveries to the lab;
- Communicating all project requirements to the laboratory in the form of a customized checklist;
- Reviewing the QAPP and guaranteeing adherence to the project requirements;
- Documenting all communications;
- Notifying the client when there are exceptions to the project requirements;
- Ensuring that samples are extracted within the holding time – preferably with adequate time to re-extract within the holding time if problems occur;
- Reviewing raw data;
- Overseeing the documentation of exceptions in a Case Narrative;
- Assembling the data package with the assistance of the report generation staff;
- Ensuring that project data are archived properly;
- Overseeing the generation of electronic deliverables (if required);

- Ensuring that samples are archived and disposed of according to the QAPP.

TRACEABILITY OF MEASUREMENTS

All measuring operations and testing equipment which have an effect on the accuracy or validity of test results shall be calibrated and/or verified before being put into service and on a continuing basis. This requirement applies to balances, thermometers, and control standards.

Traceability of Calibration

Whenever possible, equipment calibration and/or verification and validation shall be conducted so as to ensure that measurements made by the laboratory are traceable to national standards of measurement. The QAU maintains all calibration certificates to allow for traceability to these standards. Where traceability to national standards of measurement is not applicable, NCL provides satisfactory evidence of correlation of results, for example, by participating in performance evaluation studies, or independent analysis.

Reference Standards of Measurement

NCL owns two sets of Class S weights. One set serves as the primary set and is used on a daily basis. The other set is used as a back-up set and is used if the primary set is being verified and/or corrected. Each set is sent to the manufacturer or a calibration service for calibration and cleaning on an annual basis. All calibration reports are maintained by the QAU.

NCL owns two NIST traceable thermometers – the first is a partial immersion and the second is a full immersion. Both are sent to a calibration service on an annual basis for verification.

Support Equipment Calibration

Support equipment includes: balances, ovens, refrigerators, freezers, incubators, waterbaths, digital and liquid-in-glass thermometers, and autoclaves. NCL employs the following procedures to ensure the accuracy of support equipment.

1. Electronic devices are routinely checked for evidence of wiring deterioration.
2. Maintenance and service reports are kept for all equipment.
3. Support equipment is verified annually, or more often, depending on the type of equipment, using NIST traceable references when available.
4. .Mechanical volumetric pipettes (i.e.pipettors) are verified as required by GLP regulations.
5. Balances, ovens, refrigerators, freezers, and water baths are verified daily.

Instrument Calibration

Calibration of instruments is required to ensure that an analytical system is operating correctly and at the proper sensitivity to meet required reporting limits. All instruments at NCL are standardized according to manufacturer's instructions, analytical methods, and the requirements of special projects.

Three to seven point calibration curves are generated for gas chromatographs, liquid chromatographs, spectrophotometers, and the atomic absorption spectrophotometer. Gas chromatographs and liquid chromatographs are calibrated according to the appropriate method SOP using a linear curve whenever possible. Typically, if the correlation coefficient is <0.995, a quadratic fit may be used. Second source standards are used to verify the accuracy of the standards in the calibration curve. Continuing calibration standards are used to confirm the continued validity of the initial calibration.

Standards and Reagents

The validity of data generated by the laboratory rests in part on the purity and grades of reagents and standards used in analytical operations. To ensure the highest purity possible, all organic chemical primary reference standards used by NCL are obtained from reliable commercial sources such as Crescent Chemical Co., (supplier of Riedel de Häen chemical standards), Supelco, Aldrich, Chem Service, or AccuStandard. In the rare case of unavailability, an organic chemical standard may be obtained directly from the manufacturer. Second source standards if available or second lot standards are routinely used to verify the calibration standards. Atomic absorption metals standards and general "Wet Laboratory" standards are purchased from reliable commercial sources, and are all certified for purity by the manufacturer.

Records regarding analytical standard, reagent, and bacteriological media preparation are kept in bound log books. Each reagent and standard receive unique lot numbers so their use can be traced. Upon completion, logbooks are archived and kept for a minimum of six years. Stock reagent chemical and analytical standard materials are logged in and dated upon receipt. An appropriate expiration date is assigned to the material and is placed on the chemical container.

All reagent and analytical standard solutions are regularly examined for signs of deterioration and checked for proper function. The above mentioned materials are stored separate from samples and under conditions which are in accordance with EPA regulations and/or manufacturers' recommendations.

In-house reagent water quality is checked annually by an outside laboratory for water suitability and inhibitory residue. The reagent water is also checked monthly for conductivity, pH, residual chlorine, ammonia, various metals, total dissolved solids, total suspended solids, TOC, and heterotrophic bacteria plate count.

METHOD SELECTION AND VALIDATION

Analytical methods selected for use at NCL are those specified by the EPA, or other authorized agencies. The methods are selected from the following references:

1. Standard Methods for the Examination of Water and Wastewater, 18th , 19th, and 20th Editions.

2. Methods for Chemical Analysis of Water and Wastewater, EPA-600/4-79-020, April 1979, (revised March 1983).

3. Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

4. Test Methods for Evaluating Solid Wastes, Physical and Chemical Methods, SW-846, 3rd edition, November 1986, plus repeated updates.

5. Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991 (revised May 1994).

6. Methods for the Determination of Metals in Environmental Samples, Supplement I, EPA/600/R-93/100, August 1993.

7. Methods for the Determination of Metals in Environmental Samples, Supplement I, EPA/600/R-94/111, May 1994.

8. Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (600 series) EPA/600/4-82/057, July 1982.

9. "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act." 40 CFR, Part 136. Published in Federal Register, Vol.49, No.209, October 26, 1984.

10. Static Acute Bioassay Procedures for Hazardous Waste Samples, CA Dept. of Fish and Game Water Pollution Control Laboratory, November 1988.

11. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, 4th edition, EPA-600/4-90/027f, Sept. 1991.

12. Analytical methods for pesticides, plant growth regulators, and food additives / Edited by Gunter Zweig and Joseph Sherma. New York: Academic Press, 1963.

13. Methods For The Determination of Organic Compounds in Drinking Water, EPA/600/4-88/039, December 1988 (revised July 1991).

14. Methods For The Determination of Organic Compounds in Drinking Water, Supplement I EPA/600/4-90/020 July 1990.

15. Methods For The Determination of Organic Compounds in Drinking Water, Supplement 2 EPA/600/R-92/129, August 1992.

16. Methods for the Determination of Nonconventional Pesticides in Municipal and Industrial Wastewater, EPA/821/R/92/002, April 1992.

17. Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure, State of California Leaking Underground Tank Task Force, October 1989.

18. Recommended Procedures for the Examination of Seawater and Shellfish, American Public Health Association Inc., Fourth edition, 1970.

All analytical methods must be validated prior to the analysis of samples. The validation procedure follows the data package guidelines of the California Department of Health Services (DHS) – Environmental Laboratory Accreditation Program (ELAP). Method validations are performed by experienced chemists and reviewed by the appropriate laboratory supervisor and QAU before submission to ELAP. Method validations consist of, but are not limited to, the following steps:

- Initial Calibration (three to five point curve)
- Midrange continuing calibration verification standard for daily run
- Method blank
- Analysis of an actual sample
- Matrix spike and spike duplicate at 2 to 10 times the estimated reporting limit
- Method Detection Limit (MDL) determination
- Reporting limit verification
- External reference sample analysis or third lot standard analysis
- Laboratory Control Sample, if applicable
- Submittal of all raw data

METHOD DETECTION LIMIT (MDL) STUDIES

The method detection limit (MDL), as outlined in 40 CFR Part 136, Appendix B, is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. This limit is determined by analysis of a sample in a given matrix containing the analyte. Seven replicates spiked at 2 to 5 times the estimated detection limit are analyzed. The standard deviation times the Student's t value is calculated to determine the MDL. The 99% confidence interval estimates of the MDL are then calculated. Upper and lower confidence intervals (UCL and LCL) are calculated as below:

$$MDL_{LCL} = MDL \times 0.64$$
$$MDL_{UCL} = MDL \times 2.20$$

Following the calculation of the MDL, a MDL verification check sample will be analyzed to verify that the MDL is in fact detectable. For the MDL verification check sample to be considered acceptable, it must produce a response that lies at least 3× above the instrument's noise level. If the MDL verification check sample fails then a new verification check sample will be analyzed at a higher level to set a higher MDL, or the MDL study will be re-conducted. MDLs should be analyzed annually or whenever there is a change in instrumentation or test personnel.

STANDARD OPERATING PROCEDURES AND METHODS

STANDARD OPERATING PROCEDURES

Details of laboratory operations are contained in Standard Operating Procedures (SOPs). Categories of SOPs in use at NCL are listed below:

- Archives
- Facilities
- Information Systems
- Laboratory Procedures
- Laboratory Equipment
- Laboratory Methods
- Management
- Quality Assurance Unit (QAU)
- Safety
- Sample Control
- Study Directing
- Shipping/Receiving
- Training
- Waste Management
- Computer Validation

All SOPs go through an approval process before being implemented. The appropriate Lab Supervisor, the QA Officer and the Lab Manager or Director must review each SOP before it becomes effective. SOPs are controlled documents. The QAU is responsible for the distribution of current SOPs and the retrieval of outdated SOPs. SOPs are reviewed every two years or before if the procedures included therein become outdated.

METHODS

Details of analytical methods are contained in a set of documents called Methods (MEs). All MEs go through an approval process before being implemented. The appropriate Lab Supervisor, the QA Officer and the Lab Manager or Director must review each method before it becomes effective. The QAU is responsible for the distribution of current MEs and the retrieval of outdated MEs. Methods are updated as soon as the procedures included therein become outdated.

DATA REVIEW, REPORTING, AND RECORDS RETENTION

All analytical data at NCL are scrutinized by the analyst, a peer reviewer or the laboratory supervisor, and the Quality Assurance Unit before being released to the client. The following data review procedure is followed.

Data Review

All data are checked and signed by the analyst to ensure that: the data are complete; duplicates and spikes are within acceptance ranges; reporting limits are met; all calculations are correct and specific method requirements are met.

Following careful review by the analyst, the data are examined for the above listed parameters by performing a 100% peer review. If the data are accepted the reviewer also signs the raw data. If the data do not meet the QC acceptance criteria, a corrective action is taken and the sample may be re-analyzed.

If the data are accepted, a final report is generated. The final report is examined initially by the laboratory supervisor. If the report is acceptable, the supervisor signs it and passes it to the QAU for review and signature. Once the report is approved by QAU it is passed on to management for final review by either the laboratory manager or the director. After the report is signed by management (or an authorized representative) it is copied and released to the client. If, during the review process, the data are rejected, and samples are to be re-analyzed, proper documentation must be made. A "Malfunction Report" stating the problem(s) and the corrective action(s) taken must be filled out and submitted to the QAU and to the appropriate laboratory supervisor. This procedure is addressed in more detail in section 11, entitled "Corrective Actions."

Reporting

NCL uses a Laboratory Information Management System (LIMS) along with custom applications to transfer data from instruments to computers, perform calculations, generate client reports and ensure the integrity and security of the data. The reporting format includes:

- Analytical data: the analytical result, date sampled, date received, date prepared/extracted, reporting limits, dilutions, and methods are presented in the final report.

- QA percent recoveries for matrix spikes (if applicable) and surrogates are included in most final reports.

- Custom reports: special services such as submission of complete raw data packages and CLP-like deliverables can be arranged if requested by the client.

Records Retention

All records relating to a work order or analysis done for a client will be retained for at least six years following the date on which results are reported to the client. All records relating to Hazardous Waste Bioassays and related client final reports will be maintained in archives and will not be destroyed. All study data will be retained according to GLP regulations.

QUALITY CONTROL REQUIREMENTS

The assurance of quality is dependent on the application of specific procedures which apply to all analytical samples. Every sample that enters NCL for analysis has associated with it a set of quality control data. The QC data associated with a sample are specific to a procedure or analysis. Types of analyses are divided into the following divisions: organic, wet chemistry, and metals analysis; bacteriological analysis; and aquatic bioassays. QC parameters are defined below.

QC PARAMETER DEFINITIONS

Accuracy:

Accuracy is a measurement of how close an analytical result is to the true or known value. Accuracy data are generated by performing laboratory control samples and/or matrix spikes and calculating the percent recovery for the analyte(s) of interest. NCL establishes its own acceptance limits for accuracy by calculating the standard deviation of "in-house" spike recovery values. Upper and lower warning limits are set at ± 2 standard deviations from the mean, and upper and lower control limits are set at ± 3 standard deviations from the mean. Prior to NCL's calculation and establishment of in-house limits for an analytical method, NCL uses the EPA default limits for that method.

Precision:

Precision is the degree to which analytical results are reproducible. Precision data are generated by analyzing laboratory control sample, matrix spikes, or samples in duplicate. Duplicate samples are analyzed every batch or every 20 samples. Duplicate pairs are compared to one another by calculating the relative percent difference (RPD) for each pair. In general, the RPD must be within ± 20% (the limit specified by the EPA in its Contract Lab Program). However, NCL establishes its own precision warning and control limits for each method. These limits are determined by calculating the standard deviation for the RPDs of twenty in-house duplicate pairs. The warning limits for a method are set at ± 2 standard deviations from the mean and the control limits are set at ± 3 standard deviations from the mean.

Analytical batch:

An analytical batch is a group of 20 or fewer samples of the same matrix which are prepared and analyzed together.

Method blank:

A method blank is a blank matrix (such as de-ionized water or Ottowa sand) to which all reagents are added in the same volumes or proportions as specified in the method processing. A method blank is analyzed with each analytical batch. Method blanks are analyzed to monitor the introduction of contaminants into the analytical process.

Working standard:

Working standards are analyzed with each analytical batch to calibrate instrumentation and to ensure adequate instrument performance. Calibration procedures are followed as stated in the individual methods.

Second source standards:

Second source standards, when available, or second lot standards, are made using a stock standard from a different lot # or manufacturer than the primary stock standard that is used to prepare working standards. Second lot standards, when available, are analyzed to verify the response of the primary stock standard.

Continuing calibration verification standard (CCV):

A continuing calibration verification standard is a mid-level standard analyzed during and/or at the end of an analytical batch. A continuing calibration verifies that the instrument response has not drifted from the initial calibration response. The continuing calibration standard should be within the method specified ranges to be acceptable.

Laboratory control sample:

Laboratory control samples (LCS) are analyzed to verify the acceptable performance of an analytical method. Laboratory control samples are made by fortifying a blank matrix with a known amount of analyte(s) using a primary lot standard, or equivalent. LCSs are spiked with all the analytes in each method, except for multi-peak analytes. These are prepared and analyzed at a frequency of one per batch. The results are reported as percent recovery and are

compared to either lab calculated limits or EPA default limits to determine if the analysis is in control.

Matrix spike:

Matrix spikes are performed in a specific matrix to assess the accuracy of an analytical result. A matrix spike is made by fortifying a client's sample with a known amount of analyte. Matrix spikes are fortified with all the analytes in each method, except for the multi-peak analytes. Matrix spikes are fortified with second lot standards, if available. Matrix spikes (duplicates every 20) are analyzed for every 10 drinking water samples, and for every 20 non-drinking water samples, or at least once per quarter, whichever is more frequent.

External reference standards:

External reference standards are used to validate the accuracy of working standards and second lot standards. These standards are obtained from Environmental Resource Associates (ERA), NSI Solutions, Inc. or another approved vendor. They are prepared twice yearly or more frequently if necessary.

Surrogates:

Surrogates are compounds which are similar to the analytes of interest in chemical behavior, but which are not normally found in environmental samples. Surrogates are added to the samples and their associated QC to monitor the effect of the sample matrix on the accuracy of the analysis. Percent recoveries are calculated for each surrogate. Acceptance limits are established for surrogate percent recoveries, as well.

Internal Standards:

Internal standards are added to the samples and their associated QC after extraction and prior to analysis. The same amount of internal standard is added to each standard, QC sample, and client sample. A calibration curve, that incorporates an internal standard, will "correct" the results for changes in instrument response, injection variability, etc.

ORGANIC, WET CHEMISTRY, AND METALS ANALYSIS

NCL's Quality Control (QC) procedures for organic, wet chemistry, and metals analyses include the use of method blanks, calibration standards, second lot standards, laboratory control samples and internal and/or surrogate standards (where applicable) on every analytical run, unless otherwise specified in the method. This QC is used to assess daily method performance. QC summary reports are typically included with analytical reports. Matrix spikes and duplicates are analyzed for every ten samples for drinking water (EPA 500 series analyses) and for every 20 samples for all other matrices, or once per quarter for each matrix, whichever is most frequent. This QC is used to assess the effect of the matrix on the analytical data. Matrix specific QC is available at the request of the client. External reference standards are run twice yearly to check the validity of standards. When the analysis of matrix

spikes cannot be done, external reference standards may be run with an analytical batch, depending on the requirements of the client.

Quality Control samples are fortified with a standard from either the same stock solution as the calibration standards, as in the case of laboratory control samples, or from a second source, as in the case of matrix spikes.

BACTERIOLOGICAL ANALYSIS

Multiple Tube Fermentation Test:
Completed Tests are performed on 10% of positive confirmed samples. Positive and negative bacteria control cultures are kept in the incubator and hot water bath. The control cultures used are *E. coli, Enterobacter aerogenes, Klebsiella pneumoniae and Pseudomonas aeruginosa.* The controls are re-inoculated daily and results are recorded. Duplicate samples are analyzed every twenty samples. The media pH is monitored for every batch produced. The date media is prepared and the expiration date are recorded on each batch.

Colilert Test:
Each lot of Colilert reagent (MMO-MUG) is verified with positive and negative control cultures as above. Completed Tests are performed on 5% of all positive *E. coli* samples.

AQUATIC BIOASSAYS

Static Acute Renewal and Non-renewal Bioassays:
Samples and controls are run in duplicate. Tests are invalid if less than 90% of the control organisms survive. Water temperature, pH and DO concentration are monitored daily and must be maintained within the limits specified for each test. Water chemistry is analyzed at the beginning and at the end of the test. A toxicity test with a reference toxicant is run on each new batch of test fish.

AUDITS AND PERFORMANCE EVALUATION

North Coast Laboratories participates in several external and internal audit programs.

EXTERNAL AUDIT PROGRAMS:

- Environmental Laboratory Accreditation Program (ELAP) Required Performance Testing (PT) Studies: NCL participates in the WS (Water Supply),WP (Water Pollution), SOIL, and UST performance testing programs on an annual basis. The results of the studies are distributed to ELAP and are used as the required Performance Evaluation samples for certification in California and other states.

- ELAP Microbiology Performance Evaluation Studies: NCL participates in annual microbiology proficiency testing. Successful completion is required for certification in California.

- EPA DMR QA Program: NPDES permit holders submit annual Performance Evaluation samples to NCL.

- Client Audits: Many clients conduct audits prior to using NCL as a contract facility. Any findings from these audits are resolved and addressed in a corrective action response.

INTERNAL AUDIT PROGRAMS:

- External Reference Standards: At a minimum of two times per year NCL analyzes “known” samples received from ERA, NSI, or another approved vendor. Analysts report the test sample results to the QAU. The QAU will then indicate whether the result is within the ERA established limits or not. If the result is not within the limits the test must be repeated until results are satisfactory.

- Routine NCL QC, Method Blanks, Matrix Spikes and Laboratory Control Samples: This program is outlined in detail in the section of this document entitled "Quality Control Requirements.”

- Blind Internal Split and Spike Program: Blind spikes and/or duplicate samples are prepared by the QAU and submitted to the laboratory. QAU records the results and calculates percent recoveries and/or percent differences. If an out of control result is reported, the analyst must find the source of the error and correct it. A "Malfunction Report" is then submitted to QAU. Depending on the exact circumstances, QAU may require reanalysis of the blind sample and/or increase the frequency of blind samples for that analysis.

- Semi-annual Facility Inspections: The organic and inorganic laboratories are inspected bi-annually by the QAU. An inspection form is completed and submitted to the appropriate laboratory supervisor and management. The results of these inspections are used to verify compliance with SOPs and laboratory regulatory requirements and to identify areas where additional training is needed or clarification of procedures is required.

- Annual Water Suitability: The quality of reagent water obtained from the water purification system used for bacteriological analyses is tested for the presence of toxic agents or growth-promoting substances. The test is performed annually by an outside laboratory.

PREVENTATIVE MAINTENANCE

All instruments are maintained, calibrated, and serviced according to manufacturer's instructions. Anomalies are reported immediately to the Technical Director who determines the need for adjustment or repair. A log of routine equipment maintenance and repairs is kept near each instrument and contains the following information: date, description of activity performed, and initials of the analyst.

Annual preventative maintenance and electrical safety checks are performed on the waterbaths, incubators, and autoclave. The analytical balances are inspected and maintained annually by an outside contractor

CORRECTIVE ACTIONS

Corrective actions are a set of specific procedures which are followed upon the occurrence and/or detection of errors, deficiencies or other out-of-control conditions in the analytical system. Corrective actions may be necessary if:

- QC spike and/or duplicate data are outside the specified control limits for accuracy and/or precision.
- Blank values are above acceptable levels.
- Second lot standard is out of acceptance limits.
- Continuing calibration is out of range.
- Results from external audits are unacceptable.
- Results from internal blind spike or duplicate samples are out of control.

Corrective action procedures are as follows:

- Re-analyze the sample if necessary. If the error is not reproducible, note result and take no further action. This case is considered to be a random error. If the error is reproducible, it is considered a systematic error and action to correct it must be taken; see below listed steps.
    - Discontinue analysis immediately
    - Re-check calculations
    - Check instrument calibration
    - Check working standard and spiking solutions
    - Check reagents for purity
    - Re-check analyst's procedures to ensure correct procedure was followed
- After the problem(s) is identified and corrective actions are taken and documented, re-analyze samples from out-of-control batch and continue with routine analyses.
- The out-of-control situation and the corrective actions taken to remedy the problem(s) are documented on a Malfunction Report. This report will be submitted to the appropriate laboratory supervisor and the QAU for approval.

COMPLAINTS

Client complaints are typically received by a CSR. The complaint is documented, reported to the Laboratory Manager, Lab Supervisor, and QA Unit (if related to data quality), investigated, and corrective actions taken as appropriate.

QA REPORTS

The Quality Assurance Officer is responsible for generation of several types of reports regarding the state of the laboratories' Quality Assurance program. These reports are submitted in either written or verbal format directly to management after the information is obtained by the Quality Assurance Officer. The Quality Assurance Unit, the Lab Manager, and the lab supervisors discuss current QA objectives and problems. The following items are covered in reports submitted to management:

- Facility inspections
- Performance evaluation scores
- Results of internal blind splits and/or spikes
- Problems encountered and corrective actions taken
- QA GLP audits

NORTH COAST LABORATORIES LTD.

QUALITY ASSURANCE MANUAL

North Coast Laboratories, Ltd.
5680 West End Road
Arcata, CA 95521

Phone: 707-822-4649 Fax: 707-822-6831
www.northcoastlabs.com

2005-Version 1
Effective April, 2005

Approved By:

Laura Miller
Quality Assurance Officer

Roxanne Golich-Moore
Laboratory Manager

Jesse G. Chaney
Laboratory and Technical Director

This is a controlled document.Control ID: 050518-1V05_2005

APPENDIX A
ETHICS AND DATA INTEGRITY AGREEMENT

NORTH COAST LABORATORIES LTD.

ETHICS AND DATA INTEGRITY AGREEMENT

As an employee of North Coast Laboratories I:_____
(print name)

- Understand the high standards of integrity required of me with regard to the duties I perform and the data I report
- Agree to be trustworthy in carrying out my tasks
- Agree to be responsible for my actions
- Agree to be truthful and accurate in what I say and write
- Agree to be cooperative and constructive team player
- Agree to be committed to producing scientifically sound data of the highest quality
- Agree to be economical in using company resources
- Agree to be fair and considerate in my treatment of fellow employees, clients and all other persons

More specifically, I agree that in the performance of my duties at North Coast Laboratories:

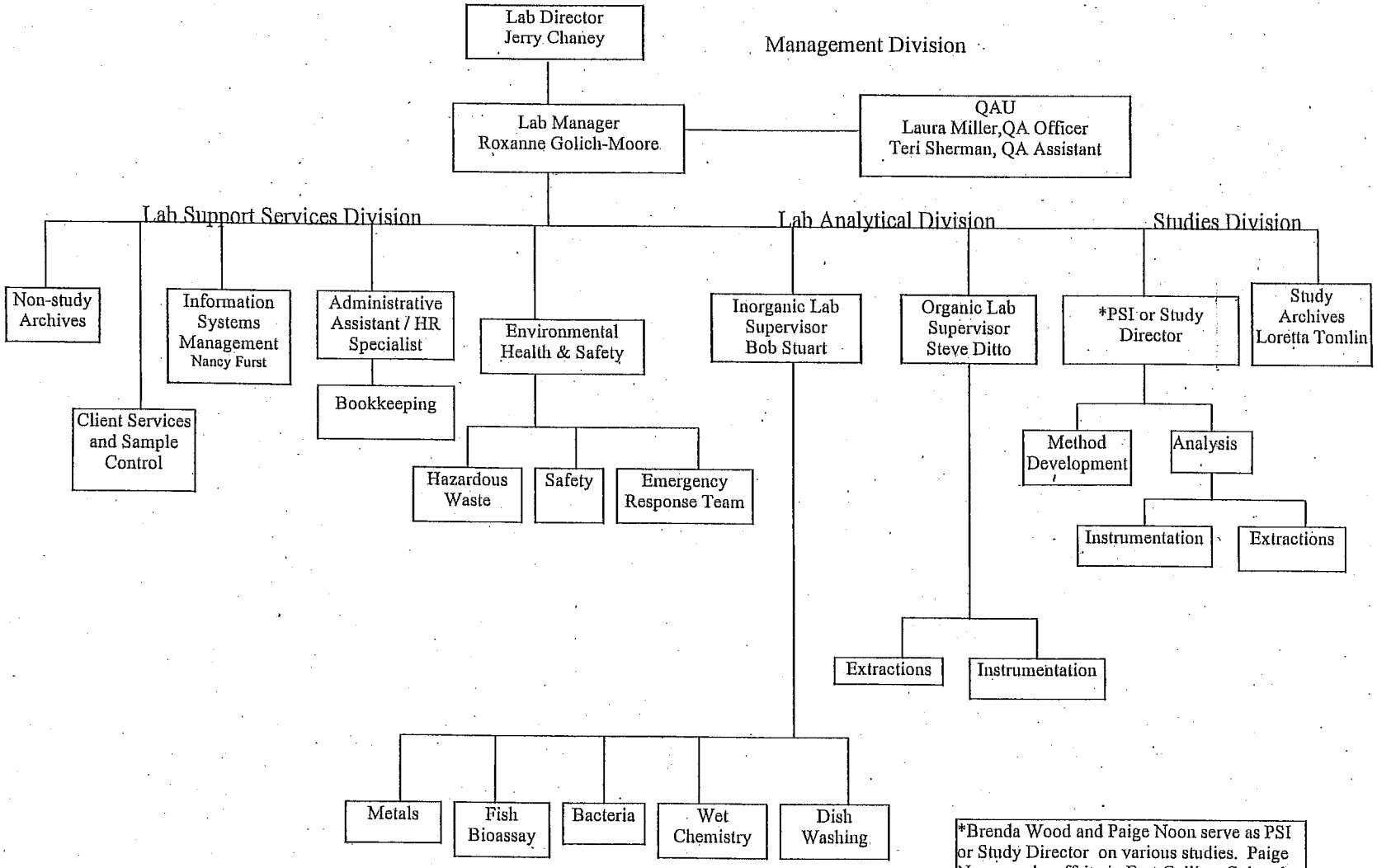
- I shall document and report to my supervisor all non-routine occurrences or information that may impact the validity of analytical results
- I shall not intentionally report data values that are not the actual values obtained
- I shall not intentionally report the dates and times of data analyses that are not the actual dates and times of data analyses
- I shall not intentionally represent another individual's work as my own
- I shall inform North Coast Laboratories of any accidental reporting of non-authenic data by myself in a timely manner
- I shall inform North Coast Laboratories in a timely manner of any accidental or intentional reporting of non-authenic data by other employees.
- I shall follow SOPs as written. If I believe the SOP is inaccurately written I shall immediately notify my supervisor.

_____ _____
Signature Date

5680 West End Road • Arcata California 95521-9202 • 707-822-4649 • FAX 707-822-6831

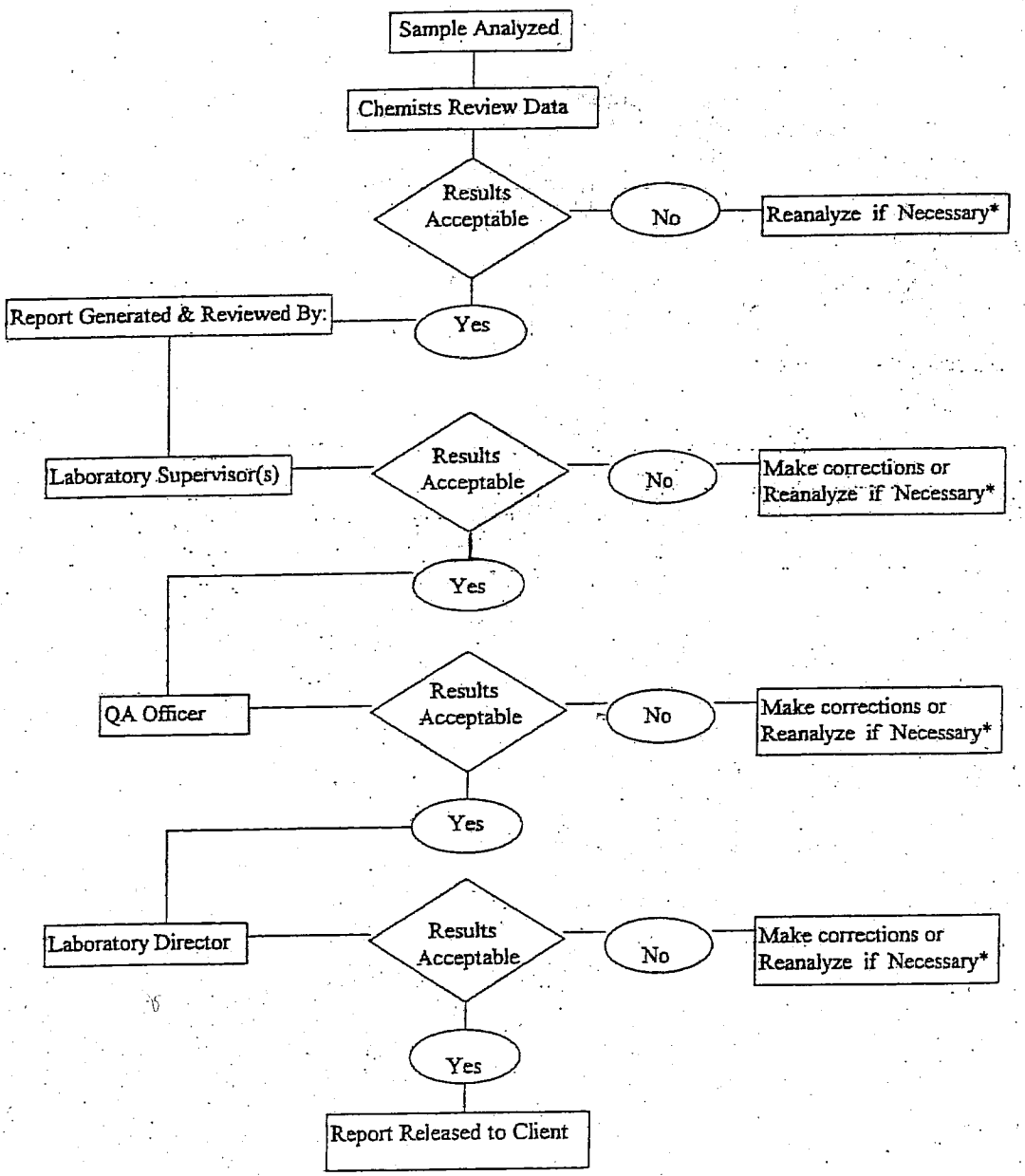
APPENDIX B
NCL ORGANIZATIONAL CHART

NORTH COAST LABORATORIES, LTD. - *Organizational Chart*



APPENDIX C
DATA REPORTING CHART

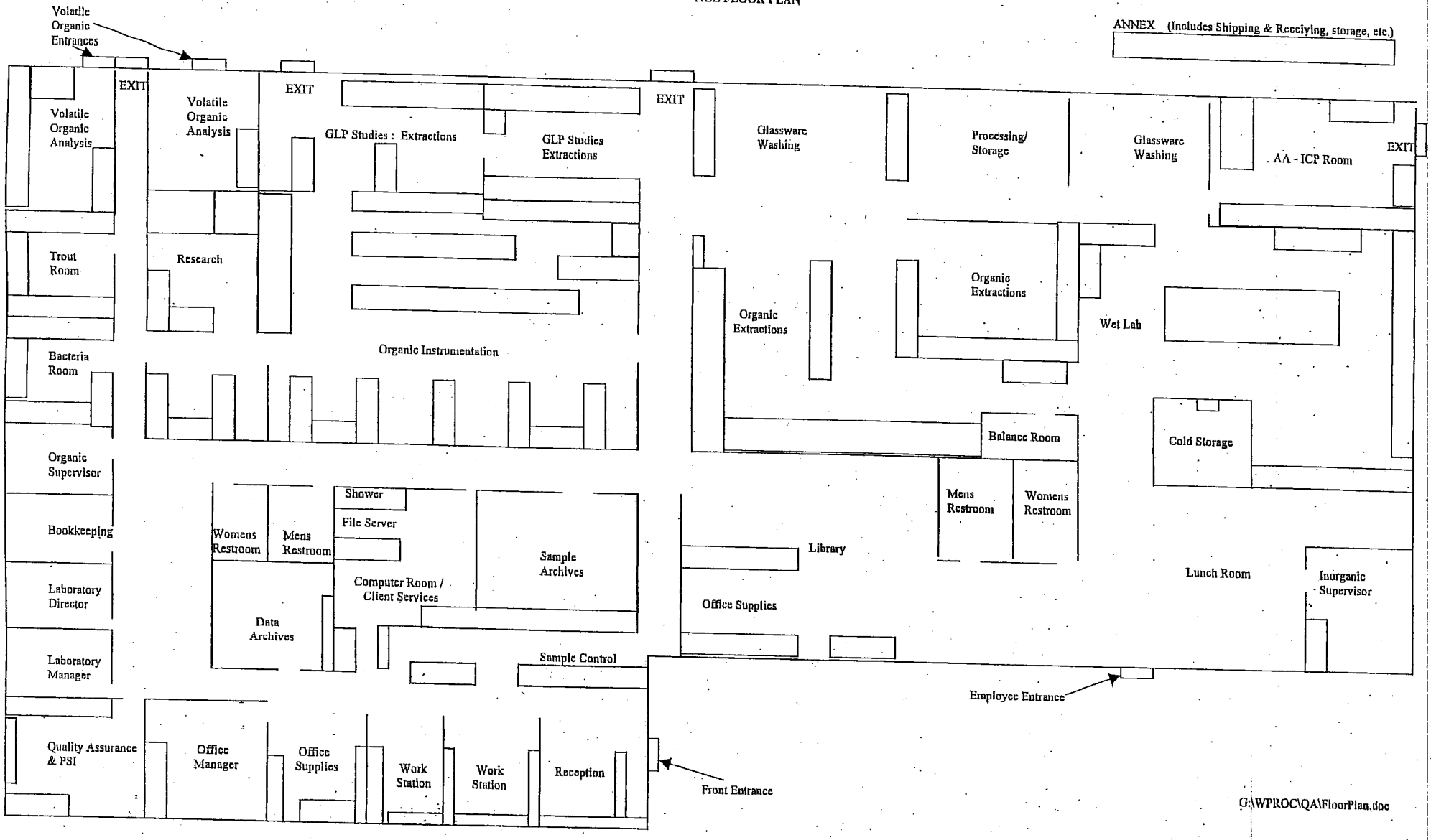
DATA REPORTING CHART



* If data are rejected and samples are to be reanalyzed, corrective actions must be documented. See "Corrective Actions" section.

APPENDIX D
NCL FLOOR PLAN

NCL FLOOR PLAN



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APPENDIX E
EQUIPMENT LIST

INSTRUMENT/EQUIPMENT	NUMBER OF UNITS	MANUFACTURER	MODEL NUMBER
4.0°C Cold Room (8x8)	1	Superfreeze	---
A.A. HCL Lamps: Cd, Cu, Fe, Hg, Mn, Pb, Sb, Tl, Zn	1 each	Perkin Elmer and Thermo Jarrell Ash	---
A.A. EDL Lamps: As,Se	1	Perkin Elmer	System 2
Air Conditioners	1	Sears	2537792580
Air Conditioners	1	Sears	2538782590
Analytical Balance	1	Mettler	H31-A12
Atomic Absorption Spectrophotometer	2	Thermo Jarrell Ash/ Perkin Elmer	Video 12/ 4100 ZL
Auto Samplers	6	Varian	Various
Auto Samplers	2	Varian	Archon
Auto Samplers	2	Hewlett Packard	7673
Auto Samplers	4	Perkin Elmer	Various
Auto Samplers	2	Tekmar	Aquatek 50
Auto Sampler	1	Thermo Jarrell Ash	Fastac II
Autoclave	1	Market Forge	Sterilmatic
Automatic Dispenser	1	Oxford Labs	472A
Centrifuge	3	Fisher Scientific (2)/IEC	Medispin/Centra-8
Certified Thermometer	2	VWR	---
COD Reactor	1	Hach	45600
Cold Vapor Hg Analysis System	1	Thermo Jarrell Ash	Video 12 AA Atomic Vapor Accessory 440
Colony Counter	1	American Optical	3325
Conductivity Meter	2	Y.S.I./Orion	31/140
Digital Titrator	1	Hach	16900-01
Diode Array Detector	1	Perkin Elmer	235C
Dissolved Oxygen Meter	2	Orion	850 A+ and 862 A
Distillation Apparatus	4	Glas-Col (heating unit) C.F. Scientific Glass(glass unit)	---
Distillation Unit	1	Glastron	

INSTRUMENT/EQUIPMENT	NUMBER OF UNITS	MANUFACTURER	MODEL NUMBER
Dithiocarbamate Digester	6	Glas-Col (heating unit) C.F. Scientific Glass(glass unit)	---
Drying Oven	3	Blue-M / Yamato	OU-18A / DVS 400
Dual Reagent Pump	2	Pickering	---
Electron Capture Detector	5	Varian	---
Electron Capture Detector	2	Hewlett Packard	---
Extraction Heaters	4	Lab Line	5000
Flame Burner	1	Thermo Jarrell Ash	---
Flame Ionization Detector	2	Varian	---
Fluorescence Detector	1	Varian	Fluorochrome
Fluorescence Detector	2	Perkin Elmer	LC-240
Fume Hoods	13	Labconco	---
Gas Chromatograph	1	Varian	6000
Gas Chromatograph	1	Varian	CP-3800
Gas Chromatograph	9	Varian	3400
Gas Chromatograph	1	Hewlett Packard	5890
Gas Chromatograph/ Mass Spectrometer	3	Hewlett Packard	5890/5972 & 6890/5973
Gel Permeation Chromatograph	1	ABC Instruments	AS-200
Hall Detector	2	Tracor	1000
Heating Blocks	3	Lab Line	5000
Heating Mantles	8	Glas-Col	TM110
Hot Block Digester	1	Environmental Express	---
Hot Plate Stirrers	20	Various	Various
Incubator (Bacteria)	2	Lab-Line/Thelco	Imperial II/31718
Incubator (BOD)	1	Precision	---
Inductively Coupled Argon Plasma Spectrometer	1	Thermo Jarrell Ash	61E
Ion Chromatograph Autosampler	1	Dionex	AS40
ICP-MS	1	Perkin Elmer	ELAN 9000

INSTRUMENT/EQUIPMENT	NUMBER OF UNITS	MANUFACTURER	MODEL NUMBER
Ion Chromatograph	1	Dionex	DX120
Kjeldahl Digester	4	Precision Scientific	55345
Kuderna-Danish Apparatus	16	Supelco	250 mL
Light Meter	1	Environmental Concepts	LIM HID
Liquid Chromatograph	2	Varian	230
Liquid Chromatograph	3	Perkin Elmer	Various
LC APCI Unit	1	Sciex	14368 J
LC API Gas Generator	1	Peak	NM20ZA
LC Autosampler	1	Perkin Elmer	Series 200
LC Fiber Light	1	Dolan-Jenner	190
LC Mass Spectrometer	1	Sciex	API 3000
LC Pump Controller	1	Shimadzu	SCL-10Aup
LC Pump	2	Shimadzu	LC-10Adup
LC Syringe Pump	1	Cole Parmer	74900 Series
LC Turbo Ion Spray	1	Sciex	019296 B
LC Vacuum Pump	1	Varian	949-9335S001
Mercury Water Bath	1	Blue-M	Magniwhirl
Microscope (Compound)	1	Swift	MA-738
Microscope (Dissecting)	1	Olympus	SZ
Muffle Furnace	2	Thermolyne / Fisher Scientific	6000 / 550.14
N-EVAP	3	Organomation Associates Inc.	2D93 (2)/111
Nephelometer	2	Turner / HF Scientific	40 / Micro 100
NH4+ Specific Ion Electrode	1	Orion	---
pH Meter / Ion Analyzer	3	Orion	EA 940 / 720 A+ / 310
Photoionization Detector	3	Tracor	---
Purge	3	Tekmar	LSC-2/LCS2000
Purge	2	Hewlett Packard	Various
Reacti-Therms	2	Pierce	8800/8835
Recording Thermograph	6	Various	Various

INSTRUMENT/EQUIPMENT	NUMBER OF UNITS	MANUFACTURER	MODEL NUMBER
Recording Thermograph	4	Onset	HOBO
Rotary Evaporators	4	Buchi	RE-121
Shaker (Wet)	2	Burrell	75
Sonic Dismemberator	1	Fisher Scinetific	500
Thermionic Detector	4	Varian	---
Top-Loading Balance	3	Sartorius/Mettler(2)	L-310/BB300/PB302
Top-Loading Balance	1	Mettler	PJ 6000
Top-Loading Balance	1	O-Haus	C-305-S
Ultrasonic Baths	2	Branson	5200
UV Detector	1	Varian	325
UV Detector	2	Perkin Elmer	LC-95
UV-Vis Detector	1	Shimadzu	SPD-10AV
UV-Vis Spectrometer	2	Spectronic / Perkin Elmer	20 D+ / Lambda 40
Walk-in Freezer	2	Kalt/ICS	10x10/12x8
Water Baths	5	Blue M / VWR Scientific / Fisher Scientific / Yamato / Lindberg-blue	BS-68 / ISOTEMP 128
Water Purification	1 1	Barnstead Barnstead	NANOpure# D4741 Ropure ST# D6311
Vortex Mixers	2	VWR	K-550-G

APPENDIX F
CA DHS – ELAP CERTIFICATE

State of California—Health and Human Services Agency
Department of Health Services

SANDRA SHEWRY
Director

ARNOLD SCHWARZENEGGER
Governor

February 28, 2005

Certificate No.: 1247

JESSE G. CHANEY
NORTH COAST LABORATORIES, LTD.
5680 WEST END ROAD
ARCATA, CA 95521

Dear JESSE G. CHANEY:

This is to advise you that the laboratory named above has been certified as an environmental testing laboratory pursuant to the provisions of the California Environmental Laboratory Improvement Act (Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, et seq.).

The Fields of Testing for which this laboratory has been certified under this Act are indicated on the enclosed "Accredited Fields of Testing." Certification shall remain in effect until **July 31, 2006** unless revoked. This certificate is subject to an annual fee as prescribed by Section 100860(a), HSC, due on July 31, 2005.

Your application for renewal must be received 90 days before the expiration of your certificate to remain in force according to the California Code of Regulations, Title 22, Division 4, Chapter 19, Section 64801 through 64827.

Any changes in laboratory location or structural alterations, which may affect adversely the quality of analysis in the fields of testing for which the laboratory has been granted certification, require prior notification. Notification is also required for changes in ownership or laboratory director within 30 days after the change (HSC, Section 100845(b) and (d)).

Your continued cooperation is essential to maintain high quality of the data produced by environmental laboratories certified by the State of California.

If you have any questions, please contact Aida Dente at (510) 540-2800.

Sincerely,

George C. Kulasingam, Ph.D.
Program Chief
Environmental Laboratory Accreditation Program

Enclosure

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

ENVIRONMENTAL LABORATORY CERTIFICATION

Is hereby granted to

NORTH COAST LABORATORIES, LTD.

5680 WEST END ROAD

ARCATA, CA 95521

Scope of certification is limited to the
"List of Approved Fields of Testing and Analytes"
which accompanies this Certificate.

Continued certification status depends on successful completion of site visit, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No: **1247**
Expiration Date: **07/31/2006**
Effective Date: **07/01/2004**

Berkeley, California
subject to forfeiture or revocation.

George C. Kulasingam, Ph.D.
Program Chief
Environmental Laboratory Accreditation Program

CALIFORNIA DEPARTMENT OF HEALTH SERVICES
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

NORTH COAST LABORATORIES, LTD. **Lab Phone** (707)-822-4649

5680 WEST END ROAD
ARCATA, CA 95521

Certificate No: 1247 **Renew Date: 07/31/2006**

Field of Testing: 101 - Microbiology of Drinking Water			
101.010	001	Heterotrophic Bacteria	SM9215B
101.020	001	Total Coliform	SM9221A,B
101.021	001	Fecal Coliform	SM9221E (MTF/EC)
101.060	002	Total Coliform	SM9223
101.060	003	E. coli	SM9223
101.120	001	Total Coliform (Enumeration)	SM9221A,B,C
101.130	001	Fecal Coliform (Enumeration)	SM9221E (MTF/EC)
101.160	001	Total Coliform (Enumeration)	SM9223
Field of Testing: 102 - Inorganic Chemistry of Drinking Water			
102.030	001	Bromide	EPA 300.0
102.030	003	Chloride	EPA 300.0
102.030	005	Fluoride	EPA 300.0
102.030	006	Nitrate	EPA 300.0
102.030	007	Nitrite	EPA 300.0
102.030	010	Sulfate	EPA 300.0
102.100	001	Alkalinity	SM2320B
102.120	001	Hardness	SM2340B
102.130	001	Conductivity	SM2510B
102.140	001	Total Dissolved Solids	SM2540C
102.262	001	Total Organic Carbon	SM5310C
102.263	001	DOC	SM5310C
102.270	001	Surfactants	SM5540C
102.520	001	Calcium	EPA 200.7
102.520	002	Magnesium	EPA 200.7
102.520	003	Potassium	EPA 200.7
102.520	005	Sodium	EPA 200.7
102.520	006	Hardness (calc.)	EPA 200.7
Field of Testing: 103 - Toxic Chemical Elements of Drinking Water			
103.010	002	Copper	SM3111B
103.130	001	Aluminum	EPA 200.7
103.130	003	Barium	EPA 200.7
103.130	004	Beryllium	EPA 200.7
103.130	007	Chromium	EPA 200.7
103.130	008	Copper	EPA 200.7
103.130	009	Iron	EPA 200.7
103.130	011	Manganese	EPA 200.7
103.130	012	Nickel	EPA 200.7
103.130	015	Silver	EPA 200.7
103.130	017	Zinc	EPA 200.7
103.130	018	Boron	EPA 200.7
103.150	002	Antimony	EPA 200.9
103.150	003	Arsenic	EPA 200.9
103.150	005	Cadmium	EPA 200.9
103.150	006	Chromium	EPA 200.9

As of 02/28/2005, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

103.150	009	Lead	EPA 200.9
103.150	012	Selenium	EPA 200.9
103.150	014	Thallium	EPA 200.9
103.150	015	Vanadium	EPA 200.9
103.160	001	Mercury	EPA 245.1
Field of Testing: 104 - Volatile Organic Chemistry of Drinking Water			
104.010	000	Volatile Organic Compounds	EPA 502.2
104.010	001	Benzene	EPA 502.2
104.010	007	n-Butylbenzene	EPA 502.2
104.010	008	sec-Butylbenzene	EPA 502.2
104.010	009	tert-Butylbenzene	EPA 502.2
104.010	010	Carbon Tetrachloride	EPA 502.2
104.010	011	Chlorobenzene	EPA 502.2
104.010	015	2-Chlorotoluene	EPA 502.2
104.010	016	4-Chlorotoluene	EPA 502.2
104.010	019	1,3-Dichlorobenzene	EPA 502.2
104.010	020	1,2-Dichlorobenzene	EPA 502.2
104.010	021	1,4-Dichlorobenzene	EPA 502.2
104.010	022	Dichlorodifluoromethane	EPA 502.2
104.010	023	1,1-Dichloroethane	EPA 502.2
104.010	024	1,2-Dichloroethane	EPA 502.2
104.010	025	1,1-Dichloroethene	EPA 502.2
104.010	026	cis-1,2-Dichloroethene	EPA 502.2
104.010	027	trans-1,2-Dichloroethene	EPA 502.2
104.010	028	Dichloromethane	EPA 502.2
104.010	029	1,2-Dichloropropane	EPA 502.2
104.010	033	cis-1,3-Dichloropropene	EPA 502.2
104.010	034	trans-1,3-Dichloropropene	EPA 502.2
104.010	035	Ethylbenzene	EPA 502.2
104.010	037	Isopropylbenzene	EPA 502.2
104.010	039	Naphthalene	EPA 502.2
104.010	040	N-propylbenzene	EPA 502.2
104.010	041	Styrene	EPA 502.2
104.010	043	1,1,2,2-Tetrachloroethane	EPA 502.2
104.010	044	Tetrachloroethene	EPA 502.2
104.010	045	Toluene	EPA 502.2
104.010	047	1,2,4-Trichlorobenzene	EPA 502.2
104.010	048	1,1,1-Trichloroethane	EPA 502.2
104.010	049	1,1,2-Trichloroethane	EPA 502.2
104.010	050	Trichloroethene	EPA 502.2
104.010	051	Trichlorofluoromethane	EPA 502.2
104.010	053	1,2,4-Trimethylbenzene	EPA 502.2
104.010	054	1,3,5-Trimethylbenzene	EPA 502.2
104.010	055	Vinyl Chloride	EPA 502.2
104.010	056	Xylenes, Total	EPA 502.2
104.015	001	Bromodichloromethane	EPA 502.2
104.015	002	Bromoform	EPA 502.2
104.015	003	Chloroform	EPA 502.2
104.015	004	Dibromochloromethane	EPA 502.2
104.015	005	Trihalomethanes	EPA 502.2
104.020	002	Methyl tert-butyl Ether (MTBE)	EPA 502.2
104.020	004	tert-Amyl Methyl Ether (TAME)	EPA 502.2
104.020	005	Ethyl tert-butyl Ether (ETBE)	EPA 502.2
104.020	006	Trichlorotrifluoroethane	EPA 502.2

104.030	001	1,2-Dibromoethane	EPA 504.1
104.030	002	1,2-Dibromo-3-chloropropane	EPA 504.1
104.040	000	Volatile Organic Compounds	EPA 524.2
104.040	001	Benzene	EPA 524.2
104.040	007	n-Butylbenzene	EPA 524.2
104.040	008	sec-Butylbenzene	EPA 524.2
104.040	009	tert-Butylbenzene	EPA 524.2
104.040	010	Carbon Tetrachloride	EPA 524.2
104.040	011	Chlorobenzene	EPA 524.2
104.040	015	2-Chlorotoluene	EPA 524.2
104.040	016	4-Chlorotoluene	EPA 524.2
104.040	019	1,3-Dichlorobenzene	EPA 524.2
104.040	020	1,2-Dichlorobenzene	EPA 524.2
104.040	021	1,4-Dichlorobenzene	EPA 524.2
104.040	022	Dichlorodifluoromethane	EPA 524.2
104.040	023	1,1-Dichloroethane	EPA 524.2
104.040	024	1,2-Dichloroethane	EPA 524.2
104.040	025	1,1-Dichloroethene	EPA 524.2
104.040	026	cis-1,2-Dichloroethene	EPA 524.2
104.040	027	trans-1,2-Dichloroethene	EPA 524.2
104.040	028	Dichloromethane	EPA 524.2
104.040	029	1,2-Dichloropropane	EPA 524.2
104.040	033	cis-1,3-Dichloropropene	EPA 524.2
104.040	034	trans-1,3-Dichloropropene	EPA 524.2
104.040	035	Ethylbenzene	EPA 524.2
104.040	037	Isopropylbenzene	EPA 524.2
104.040	039	Naphthalene	EPA 524.2
104.040	041	N-propylbenzene	EPA 524.2
104.040	042	Styrene	EPA 524.2
104.040	044	1,1,2,2-Tetrachloroethane	EPA 524.2
104.040	045	Tetrachloroethene	EPA 524.2
104.040	046	Toluene	EPA 524.2
104.040	048	1,2,4-Trichlorobenzene	EPA 524.2
104.040	049	1,1,1-Trichloroethane	EPA 524.2
104.040	050	1,1,2-Trichloroethane	EPA 524.2
104.040	051	Trichloroethene	EPA 524.2
104.040	052	Trichlorofluoromethane	EPA 524.2
104.040	054	1,2,4-Trimethylbenzene	EPA 524.2
104.040	055	1,3,5-Trimethylbenzene	EPA 524.2
104.040	056	Vinyl Chloride	EPA 524.2
104.040	057	Xylenes, Total	EPA 524.2
104.045	001	Bromodichloromethane	EPA 524.2
104.045	002	Bromoform	EPA 524.2
104.045	003	Chloroform	EPA 524.2
104.045	004	Dibromochloromethane	EPA 524.2
104.045	005	Trihalomethanes	EPA 524.2
104.050	002	Methyl tert-butyl Ether (MTBE)	EPA 524.2
104.050	004	tert-Amyl Methyl Ether (TAME)	EPA 524.2
104.050	005	Ethyl tert-butyl Ether (ETBE)	EPA 524.2
104.050	006	Trichlorotrifluoroethane	EPA 524.2
104.050	007	tert-Butyl Alcohol (TBA)	EPA 524.2
104.050	008	Carbon Disulfide	EPA 524.2
104.050	009	Methyl Isobutyl Ketone	EPA 524.2

Field of Testing: 105 - Semi-volatile Organic Chemistry of Drinking Water

105.010	000	Pesticides	EPA 505
105.010	002	Alachlor	EPA 505
105.010	004	Chlordane	EPA 505
105.010	006	Endrin	EPA 505
105.010	007	Heptachlor	EPA 505
105.010	008	Heptachlor Epoxide	EPA 505
105.010	009	Hexachlorobenzene	EPA 505
105.010	010	Hexachlorocyclopentadiene	EPA 505
105.010	011	Lindane	EPA 505
105.010	012	Methoxychlor	EPA 505
105.010	014	Toxaphene	EPA 505
105.010	015	PCBs as Aroclors (screen)	EPA 505
105.020	001	Di(2-ethylhexyl) Adipate	EPA 506
105.020	002	Di(2-ethylhexyl) Phthalate	EPA 506
105.020	003	Adipates	EPA 506
105.020	004	Phthalates	EPA 506
105.030	000	N-, P- Pesticides	EPA 507
105.030	001	Alachlor	EPA 507
105.030	002	Atrazine	EPA 507
105.030	007	Molinate	EPA 507
105.030	009	Simazine	EPA 507
105.030	010	Thiobencarb	EPA 507
105.040	000	Chlorinated Pesticides	EPA 508
105.040	003	Chlordane (total)	EPA 508
105.040	007	Endrin	EPA 508
105.040	008	Heptachlor	EPA 508
105.040	009	Heptachlor Epoxide	EPA 508
105.040	010	Hexachlorobenzene	EPA 508
105.040	011	Hexachlorocyclopentadiene	EPA 508
105.040	012	Lindane	EPA 508
105.040	013	Methoxychlor	EPA 508
105.040	015	Toxaphene	EPA 508
105.040	016	PCBs as Aroclors (screen)	EPA 508
105.070	001	Bentazon	EPA 515.1
105.070	002	2,4-D	EPA 515.1
105.070	003	Dalapon	EPA 515.1
105.070	005	Dinoseb	EPA 515.1
105.070	006	Pentachlorophenol	EPA 515.1
105.070	007	Picloram	EPA 515.1
105.070	008	2,4,5-TP	EPA 515.1
105.070	009	Chlorinated Acids	EPA 515.1
105.082	001	2,4-D	EPA 515.3
105.082	002	Dinoseb	EPA 515.3
105.082	003	Pentachlorophenol	EPA 515.3
105.082	004	Picloram	EPA 515.3
105.082	005	2,4,5-TP	EPA 515.3
105.082	006	Bentazon	EPA 515.3
105.082	007	Dalapon	EPA 515.3
105.082	009	Chlorinated Acids	EPA 515.3
105.100	000	Carbamates	EPA 531.1
105.100	005	Carbofuran	EPA 531.1
105.100	008	Oxamyl	EPA 531.1
105.120	001	Glyphosate	EPA 547
105.140	001	Endothall	EPA 548.1

105.150	001	Diquat	EPA 549.2
105.161	000	Polynuclear Aromatic Hydrocarbons	EPA 550.1
105.161	001	Benzo(a)pyrene	EPA 550.1
105.190	001	Bromoacetic Acid	SM6251B
105.190	003	Chloroacetic Acid	SM6251B
105.190	004	Dalapon	SM6251B
105.190	005	Dibromoacetic Acid	SM6251B
105.190	006	Dichloroacetic Acid	SM6251B
105.190	007	Trichloroacetic Acid	SM6251B
105.190	008	Haloacetic Acids (HAA5)	SM6251B
105.200	001	Bromoacetic Acid	EPA 552.2
105.200	003	Chloroacetic Acid	EPA 552.2
105.200	005	Dibromoacetic Acid	EPA 552.2
105.200	006	Dichloroacetic Acid	EPA 552.2
105.200	007	Trichloroacetic Acid	EPA 552.2
105.200	008	Haloacetic Acids (HAA5)	EPA 552.2
Field of Testing:		107 - Microbiology of Wastewater	
107.010	001	Heterotrophic Bacteria	SM9215B
107.020	001	Total Coliform	SM9221B
107.040	001	Fecal Coliform	SM9221C,E (MTF/EC)
Field of Testing:		108 - Inorganic Chemistry of Wastewater	
108.090	001	Residue, Volatile	EPA 160.4
108.110	001	Turbidity	EPA 180.1
108.112	001	Boron	EPA 200.7
108.112	002	Calcium	EPA 200.7
108.112	003	Hardness (calc.)	EPA 200.7
108.112	004	Magnesium	EPA 200.7
108.112	005	Potassium	EPA 200.7
108.112	007	Sodium	EPA 200.7
108.120	001	Bromide	EPA 300.0
108.120	002	Chloride	EPA 300.0
108.120	003	Fluoride	EPA 300.0
108.120	004	Nitrate	EPA 300.0
108.120	005	Nitrite	EPA 300.0
108.120	006	Nitrate-nitrite, Total	EPA 300.0
108.120	007	Phosphate, Ortho	EPA 300.0
108.120	008	Sulfate	EPA 300.0
108.174	001	Chlorine Residual, Total	EPA 330.5
108.202	001	Ammonia	EPA 350.3
108.213	001	Kjeldahl Nitrogen	EPA 351.4
108.250	001	Dissolved Oxygen	EPA 360.1
108.262	001	Phosphate, Ortho	EPA 365.2
108.263	001	Phosphorus, Total	EPA 365.2
108.323	001	Chemical Oxygen Demand	EPA 410.4
108.360	001	Phenols, Total	EPA 420.1
108.380	001	Oil and Grease	EPA 1664
108.410	001	Alkalinity	SM2320B
108.420	001	Hardness (calc.)	SM2340B
108.430	001	Conductivity	SM2510B
108.440	001	Residue, Total	SM2540B
108.441	001	Residue, Filterable	SM2540C
108.442	001	Residue, Non-filterable	SM2540D
108.443	001	Residue, Settleable	SM2540F

108.490	001	pH	SM4500-H+ B
108.590	001	Biochemical Oxygen Demand	SM5210B
108.591	001	Carbonaceous BOD	SM5210B
108.611	001	Total Organic Carbon	SM5310C
108.640	001	Surfactants	SM5540C
108.650	001	Tannin and Lignin	SM5550B
Field of Testing: 109 - Toxic Chemical Elements of Wastewater			
109.010	001	Aluminum	EPA 200.7
109.010	002	Antimony	EPA 200.7
109.010	003	Arsenic	EPA 200.7
109.010	004	Barium	EPA 200.7
109.010	005	Beryllium	EPA 200.7
109.010	007	Cadmium	EPA 200.7
109.010	009	Chromium	EPA 200.7
109.010	010	Cobalt	EPA 200.7
109.010	011	Copper	EPA 200.7
109.010	012	Iron	EPA 200.7
109.010	013	Lead	EPA 200.7
109.010	015	Manganese	EPA 200.7
109.010	016	Molybdenum	EPA 200.7
109.010	017	Nickel	EPA 200.7
109.010	019	Selenium	EPA 200.7
109.010	021	Silver	EPA 200.7
109.010	026	Vanadium	EPA 200.7
109.010	027	Zinc	EPA 200.7
109.190	001	Mercury	EPA 245.1
109.811	001	Chromium (VI)	SM3500-Cr D
Field of Testing: 110 - Volatile Organic Chemistry of Wastewater			
110.010	000	Halogenated Volatiles	EPA 601
110.020	000	Aromatic Volatiles	EPA 602
Field of Testing: 111 - Semi-volatile Organic Chemistry of Wastewater			
111.030	000	Phthalate Esters	EPA 606
111.170	030	Organochlorine Pesticides	EPA 608
111.170	031	PCBs	EPA 608
111.210	000	Carbamates	EPA 632
Field of Testing: 113 - Whole Effluent Toxicity of Wastewater			
113.010	001A	Fathead Minnow (P. promelas)	EPA 600/4-90/027F, Static
113.010	001B	Fathead Minnow (P. promelas)	EPA 600/4-90/027F, Static Renewal
113.010	003A	Rainbow trout (O. mykiss)	EPA 600/4-90/027F, Static
113.010	003B	Rainbow trout (O. mykiss)	EPA 600/4-90/027F, Static Renewal
113.022	003B	Rainbow trout (O. mykiss)	EPA 2019 (EPA-821-R-02-012), Static
Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste			
114.010	001	Antimony	EPA 6010B
114.010	002	Arsenic	EPA 6010B
114.010	003	Barium	EPA 6010B
114.010	004	Beryllium	EPA 6010B
114.010	005	Cadmium	EPA 6010B
114.010	006	Chromium	EPA 6010B
114.010	007	Cobalt	EPA 6010B
114.010	008	Copper	EPA 6010B
114.010	009	Lead	EPA 6010B
114.010	010	Molybdenum	EPA 6010B

114.010	011	Nickel	EPA 6010B
114.010	012	Selenium	EPA 6010B
114.010	013	Silver	EPA 6010B
114.010	015	Vanadium	EPA 6010B
114.010	016	Zinc	EPA 6010B
114.103	001	Chromium (VI)	EPA 7196A
114.140	001	Mercury	EPA 7470A
114.141	001	Mercury	EPA 7471A
114.241	001	pH	EPA 9045
Field of Testing: 115 - Extraction Test of Hazardous Waste			
115.021	001	TCLP Inorganics	EPA 1311
115.022	001	TCLP Extractables	EPA 1311
115.030	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II
Field of Testing: 116 - Volatile Organic Chemistry of Hazardous Waste			
116.010	000	EDB and DBCP	EPA 8011
116.030	001	Gasoline-range Organics	EPA 8015B
116.040	060	Halogenated Volatiles	EPA 8021B
116.040	061	Aromatic Volatiles	EPA 8021B
116.040	062	BTEX	EPA 8021B
116.080	000	Volatile Organic Compounds	EPA 8260B
116.080	120	Oxygenates	EPA 8260B
116.100	001	Total Petroleum Hydrocarbons - Gasoline	LUFT GC/MS
116.100	010	BTEX and MTBE	LUFT GC/MS
116.110	001	Total Petroleum Hydrocarbons - Gasoline	LUFT
Field of Testing: 117 - Semi-volatile Organic Chemistry of Hazardous Waste			
117.010	001	Diesel-range Total Petroleum Hydrocarbons	EPA 8015B
117.016	001	Diesel-range Total Petroleum Hydrocarbons	LUFT
117.140	000	Polynuclear Aromatic Hydrocarbons	EPA 8310
117.150	000	Carbonyl Compounds	EPA 8315A
117.210	000	Organochlorine Pesticides	EPA 8081A
117.240	000	Organophosphorus Pesticides	EPA 8141A
117.250	000	Chlorinated Herbicides	EPA 8151A
Field of Testing: 119 - Toxicity Bioassay of Hazardous Waste			
119.010	001	Fathead Minnow (P. promelas)	Polisini & Miller (CDFG 1988)
119.010	003	Rainbow trout (O. mykiss)	Polisini & Miller (CDFG 1988)
Field of Testing: 126 - Microbiology of Recreational Water			
126.010	001	Total Coliform (Enumeration)	SM9221A,B,C
126.030	001	Fecal Coliform (Enumeration)	SM9221E

APPENDIX G
STATISTICAL PROCEDURES FOR CALCULATING PRECISION, ACCURACY, AND STANDARD DEVIATION

Relative Percent Difference, (precision), is calculated as follows:

$$\left(\frac{X_1 - X_2}{M}\right) \times 100$$

X_1 = original sample or sample + spike value
X_2 = duplicate sample or sample + spike value
M = mean sample or sample + spike value

Percent Recovery, (accuracy), is calculated as follows:

$$\left(\frac{S_2 - S_1}{S}\right) \times 100$$

S_2 = value of spike and sample
S_1 = value of sample
S = amount of spike added

Standard Deviation is calculated as follows (as used in calculating QC acceptance limits):

$$\left[\frac{\Sigma (X_i - M)^2}{n - 1}\right]^{1/2}$$

X_i = Relative Percent Difference (RPD) of duplicate pair "i", or the percent recovery of spike "i"
M = mean of 20 RPD's, or of 20 spiked samples
n = the number of duplicate pairs, or of spiked samples

APPENDIX H
MALFUNCTION REPORT

Malfunction Report

Malfunction Type: _____

A. QC Limit(s) Exceeded
B. Equipment Failure
C. Standard(s) out of Range
D. Other

Name: _____ Department: _____

Reported to: _____ Date of Malfunction: _____

Equipment or Test Code: _____

Affected Work Order(s): _____

Matrix: ❑ Soil ❑ Drinking Water ❑ Waste Water ❑ Other

Description of Problem: _____

_____

_____

_____

_____

_____

Corrective Action or Explanation of Malfunction: _____

_____

_____

_____

_____

_____

Date Resolved: _____ Initials: _____

_____ _____

Laboratory Supervisor QAU

APPENDIX I
CHAIN OF CUSTODY

NORTH COAST LABORATORIES LTD.
5680 West End Road • Arcata • CA 95521-9202
707-822-4649 Fax 707-822-6831

Chain of Custody

LABORATORY NUMBER:

Attention: _____
Results & Invoice to: _____
Address: _____
_____
Phone: _____
Copies of Report to: _____
_____
Sampler (Sign & Print): _____

PROJECT INFORMATION

Project Number: _____
Project Name: _____
Purchase Order Number: _____

TAT: ☐ 24 Hr ☐ 48 Hr ☐ 5 Day ☐ 5–7 Day
☐ STD (2–3 Wk) ☐ Other: _____
PRIOR AUTHORIZATION IS REQUIRED FOR RUSHES

REPORTING REQUIREMENTS: State Forms ☐
Preliminary: FAX ☐ Verbal ☐ By: __/__/__
Final Report: FAX ☐ Verbal ☐ By: __/__/__

CONTAINER CODES: 1—½ gal. pl; 2—250 ml pl; 3—500 ml pl; 4—1 L Nalgene; 5—250 ml BG; 6—500 ml BG; 7—1 L BG; 8—1 L cg; 9—40 ml VOA; 10—125 ml VOA; 11—4 oz glass jar; 12—8 oz glass jar; 13—brass tube; 14—other

PRESERVATIVE CODES: a—HNO_3; b—HCl; c—H_2SO_4; d—$Na_2S_2O_3$; e—NaOH; f—$C_2H_3O_2Cl$; g—other

LAB ID	SAMPLE ID	DATE	TIME	MATRIX*	CONTAINER	PRESERVATIVE	ANALYSIS

SAMPLE CONDITION/SPECIAL INSTRUCTIONS

RELINQUISHED BY (Sign & Print)	DATE/TIME	RECEIVED BY (Sign)	DATE/TIME

SAMPLE DISPOSAL
☐ NCL Disposal of Non-Contaminated
☐ Return ☐ Pickup

CHAIN OF CUSTODY SEALS Y/N/NA
SHIPPED VIA: UPS Air-Ex Fed-Ex Bus Hand

***MATRIX:** DW=Drinking Water; Eff=Effluent; Inf=Influent; SW=Surface Water; GW=Ground Water; S=Soil; O=Other.

ALL CONTAMINATED NON-AQUEOUS SAMPLES WILL BE RETURNED TO CLIENT

APPENDIX J
SAMPLE RECEIPT CHECKLIST

SAMPLE RECEIPT AND LOGIN CHECKLIST

SAMPLE RECEIPT

COC signed and dated?	Yes	No	NA	
Sample temperature noted?	Yes	No	NA	
Was temp between 2 and 6°C?	Yes	No	NA	If no, notify client
Was preservation performed and or/checked?	Yes	No	NA	
Were inconsistencies between labels and COC?	Yes	No	NA	If no, notify client
Has lab been notified of expiring and RUSH samples?	Yes	No	NA	
Has CSR been notified that samples are in?	Yes	No	NA	

Sample Custodian (Initial): _____ **Date:** _____

SAMPLE LOGIN

Are reporting and invoice addresses correct?	Yes	No	NA
Is the report to line correct?	Yes	No	NA
Is order name correct?	Yes	No	NA
Is the date received correct?	Yes	No	NA
Was PO# entered?	Yes	No	NA
Do client sample ID's match COC?	Yes	No	NA
Are the collection dates and times correct?	Yes	No	NA
Is the client name in invoice section for paypickup/cash cust?	Yes	No	NA

Reviewed By (Initial): _____ **Date:** _____

CLIENT SERVICES CHECK

Is the due date correct?	Yes	No	NA
Is the QC level correct?	Yes	No	NA
Are the correct tests logged in?	Yes	No	NA
Does pricing match quote or contract?	Yes	No	NA
Are the deliverables marked correctly on the folder?	Yes	No	NA

Reviewed By (Initial): _____ **Date:** _____

Additional project specific requirements

NORTH COAST LABORATORIES
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APPENDIX K
NCL REQUIRED CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

NCL REQUIRED CONTAINERS, PRESERVATIVES & HOLDING TIMES

REVISED: May 2005
DEPARTMENT: Organics

TEST	CONTAINER	PRESERVATIVE	HOLDING TIME	REQUIRED AMOUNT	PREFERRED AMOUNT
EPA 502.2	(2) 40 mL VOA + Travel Blank	3 drops 1:1 HCl 3 mg Na2S2O3[1], Cool 4ºC	14 Days	2 Full VOA	
EPA 504.1	(2) 40 mL VOA + Travel Blank	9mg $Na_2S_2O_3$ Cool 4ºC	14 Days	2 Full VOA	
EPA 505	125 ml Amber Glass	9mg Na2S2O3, Cool 4ºC	14 Days (Heptachlor epoxide: 7 Days)	125 mL	
EPA 506 (DEHP)	1 Liter Amber Glass	60mg $Na_2S_2O_3$, Cool 4ºC	14 Days	500mL	2L
EPA 507	1 Liter Amber Glass	80mg $Na_2S_2O_3$, Cool 4ºC	14 Days	500mL	2L
EPA 507 UCMR	(2) 1 Liter Amber Glass	80mg $Na_2S_2O_3$, Cool 4ºC	14 Days	500mL	2L
EPA 508	1 Liter Amber Glass	80mg $Na_2S_2O_3$, Cool 4ºC	7 Days (Chlorothalonil: Immediate)	500mL	2L
EPA 508 UCMR	(2) 1 Liter Amber Glass	80mg $Na_2S_2O_3$, Cool 4ºC	7 Days	500mL	2L
EPA 515.1	1 Liter Amber Glass	80mg $Na_2S_2O_3$, Cool 4ºC	14 Days	500mL	2L
EPA 515.3	125 ml Amber Glass	10 mg Na2S2O3, Cool 4ºC	14 Days	30 mL	
EPA 515.1 UCMR	(2) 1 Liter Amber Glass	80mg $Na_2S_2O_3$, Cool 4ºC	14 Days	500mL	2L
EPA 524.2 EPA 524.2 UCMR	(2) 40 mL VOA + Travel Blank (4) 40 mL VOA + Travel Blank	3 drops 1:1 HCl 3 mg $Na_2S_2O_3$ [1] Cool 4ºC	14 Days	2 Full VOA	
EPA 525.2 EPA 525.2 UCMR	1 Liter Amber Glass (2) 1 Liter Amber Glass	50 mg Na_2SO_3 [1](sodium sulfite) HCL to pH <2 Cool 4ºC	7 Days	1L	2L
EPA 531.1	(1) 40 mL Amber VOA	$C_2H_3O_2Cl$ to pH 3, 10mg $Na_2S_2O_3$	28 Days	5 mL	40 mL
EPA 547(w)	125 mL Amber Glass	10 mg $Na_2S_2O_3$, Freeze	14 Days / 18 months if frozen	50mL	125mL

[1] Add Na2S2O3 only if residual chlorine is present. Do not add the acid and the Na2S2O3 to the VOA before the samples is collected because elemental sulfur may form. If the source is chlorinated, have the VOA preserved with Na2S2O3 and send a dropper bottle of HCl with an instruction sheet.

TEST	CONTAINER	PRESERVATIVE	HOLDING TIME	REQUIRED AMOUNT	PREFERRED AMOUNT
EPA 548.1(w)	500 mL Amber Glass	80 mg $Na_2S_2O_3$ Cool 4ºC	7 Days	100mL	500 mL
EPA 549.2(w)	1 Liter Brown PVC	100 mg $Na_2S_2O_3$, Cool 4ºC	7 Days	250mL	1L
EPA 550.1(w)	1 Liter Amber Glass	100 mg $Na_2S_2O_3$, Cool 4ºC	7 Days	500mL	2L
EPA 552.2	(2) 60 mL VOA	6 drops 0.5N NH_4Cl	14 Days to extract; 7 Days to analyze	50 mL	120 mL
EPA 601	(3) 40 mL VOA + Travel Blank	4 drops 10% $Na_2S_2O_3$ [2] (only if chlorinated) Cool 4ºC	14 Days	3 Full VOA	
EPA 602	(3) 40 mL VOA + Travel Blank	3 drops 1:1 HCl 4 drops 10% $Na_2S_2O_3$ [2] (only if chlorinated) Cool 4ºC	14 Days	3 Full VOA	
EPA 601/602	(6) 40 mL VOA + Travel Blank	(2 VOA) no preservative (2 VOA) 3 drops 1:1 HCl	14 Days	6 Full VOA	
EPA 603	(2) 40 mL VOA + Travel Blank	2 Drops 1:1 HCl; 4 drops 10% $Na_2S_2O_3$ (only if chlorinated) Cool 4ºC	14 Days	2 Full VOA	
EPA 604	1 Liter Amber Glass	80 mg $Na_2S_2O_3$; (only if chlorinated) Cool 4ºC	7 Days	500mL	2L
EPA 606	1 Liter Amber Glass	Cool 4ºC	7 Days	500mL	2L
EPA 608	1 Liter Amber Glass	0.75mL 10% $Na_2S_2O_3$ [3] Cool 4ºC	7 Days	500mL	2L
EPA 614	1 Liter Amber Glass	Cool 4ºC	7 Days	500mL	2L
EPA 615	1 Liter Amber Glass	Cool 4ºC	7 Days	500mL	2L
EPA 619 (w)	1 Liter Amber Glass	Cool 4ºC	7 Days	500mL	2L
EPA 624	(2) 40 mL VOA + Travel Blank	3 drops 1:1 HCl, 4 drops 10% $Na_2S_2O_3$ [2] Cool 4ºC	14 Days	2 Full VOA	
EPA 625	(2) 1 Liter Amber Glass	Cool 4ºC	7 Days	1L	2L

[2] Add Na2S2O3 only if residual chlorine is present. Do not add the acid and the Na2S2O3 to the VOA before the samples is collected because elemental sulfur may form. If the source is chlorinated, have the VOA preserved with Na2S2O3 and a dropper bottle of HCl with an instruction sheet.

[3] If samples will not be extracted within 72 hours of collection, the sample should be adjusted to pH 5.0-9.0 with NaOH or H_2SO_4.

TEST	CONTAINER	PRESERVATIVE	HOLDING TIME	REQUIRED AMOUNT	PREFERRED AMOUNT
EPA 630 (w)	(2) 1 Liter Amber Glass	Cool 4ºC ascorbic acid if chlorinated	7 Days	1L	2L
EPA 632 (w)	1 Liter Amber Glass	Cool 4ºC	7 Days	500mL	2L
EPA 633 (w)	1 Liter Amber Glass	Cool 4ºC	7 Days	500mL	2L
EPA 8021 (w) (previously 8010/8020)	(3) 40 mL VOA + Travel Blank	3drops 1:1 HCl, 4 drops 10% $Na_2S_2O_3$ [2] Cool 4ºC	14 Days	3 Full VOA	
EPA 8021 (s) (previously 8010/8020)	Brass Soil Cylinder	Cool 4ºC	14 Days	10 g	20 g
EPA 8041A (w)	1 Liter Amber Glass	0.75mL 10% $Na_2S_2O_3$ only if res.chlorine Cool 4ºC	7 Days	500mL	2L
EPA 8041A (s)	9 oz Soil Jar	Cool 4ºC	14 Days	50 g	100 g
EPA 8081 (w)	1 Liter Amber Glass	0.75mL 10% $Na_2S_2O_3$ only if res.chlorine Cool 4ºC	7 Days	500mL	2L
EPA 8081 (s)	9 oz Soil Jar	Cool 4ºC	14 Days	10 g	20 g
EPA 8141 (w)	1 Liter Amber Glass	0.75mL 10% $Na_2S_2O_3$ only if res.chlorine Cool 4ºC	7 Days	500mL	2L
EPA 8141 (s)	9 oz Soil Jar	Cool 4ºC	14 Days	10 g	20 g
EPA 8151A (w)	1 Liter Amber Glass	0.75mL 10% $Na_2S_2O_3$ only if res.chlorine Cool 4ºC	7 Days	500mL	2L
EPA 8151A (s)	9 oz Soil Jar	Cool 4ºC	14 Days	25 g	50 g
EPA 619 (s)	9 oz Soil Jar	Cool 4ºC	14 Days	10 g	20 g
EPA 630 (s)	9 oz Soil Jar	Cool 4ºC	14 Days	10 g	20 g
EPA 632 (s)	9 oz Soil Jar	Cool 4ºC	14 Days	10 g	20 g
EPA 633 (s)	9 oz Soil Jar	Cool 4ºC	14 Days	10 g	20 g
EPA 8260 (w)	(3) 40 mL VOA + Travel Blank	3 drops 1:1 HCl, 4 drops 10% $Na_2S_2O_3$ Cool 4ºC	14 Days	2 Full VOA	
EPA 8260 (w) 7 Oxygenates Lists 2 & 10	(3) 40 mL VOA and (3) 40 mL amber VOA	HCl only in the clear VOAs No preservative in the amber VOAs	14 Days	2 Full VOA	
EPA 8260 (w) Ethanol and Methanol	(3) 40 mL amber VOA	No preservative	14 Days	2 Full VOA	

TEST	CONTAINER	PRESERVATIVE	HOLDING TIME	REQUIRED AMOUNT	PREFERRED AMOUNT
EPA 8260 (s)	Brass Soil Cylinder or (2) En Core Samplers	Cool 4ºC	14 Days	10 g	50 g
EPA 8270 (w)	1 Liter Amber Glass	0.75mL 10% $Na_2S_2O_3$ only if res.chlorine Cool 4ºC	7 Days	1L	2L
EPA 8270 (s)	Brass Soil Cylinder or 9 oz Soil Jar	Cool 4ºC	14 Days	50 g	100 g
EPA 8310 (w)	1 Liter Amber Glass	0.75mL 10% $Na_2S_2O_3$ only if res.chlorine Cool 4ºC	7 Days	500mL	2L
EPA 8310 (s)	9 oz Soil Jar	Cool 4ºC	14 Days	10 g	50 g
Acephate(w)	500 mL Amber Glass	Cool 4ºC	7 Days	100mL	500mL
Aldicarb(s)	9 oz Soil Jar	Cool 4ºC	14 Days	10 g	40 g
Asphaltines (sub-test)	1 liter Amber Glass	Cool 4ºC			
Asphaltines (sub-test)	9 oz Soil Jar	Cool 4ºC			
Benomyl(w)	(1) 125 mL VOA	Cool 4ºC	7 Days	1mL	25mL
BTXE(w)	(3) 40 mL VOA + Travel Blank	3 drops 1+1 HCL	14 Days, 7 Days Unpreserved	2 VOA	3 VOA
BTXE + TPH-G(w)	(3) 40 mL VOA + Travel Blank	3 drops 1+1 HCL	14 Days, 7 Days Unpreserved	2 VOA	3 VOA
BTXE + TPH-G(s)	Brass Soil Cylinder	Cool 4ºC	14 Days	20 g	40 g
Captan(w)	1 Liter Amber Glass	Cool 4ºC	7 Days	500 mL	1L
Chloromine, Chlorine, Chlorine Dioxide (sub-test)	500 mL Plastic	Cool 4ºC			
Chlorite (sub-test)	500 mL Plastic	Cool 4ºC			
Chlorothalonil(w) (by AB1803)	250 mL Amber Glass	Cool 4ºC	7 Days	50mL	200mL
Chlorothalonil(s)	9 oz Soil Jar	Cool 4ºC	14 Days	10 g	20 g
Clopyralid (w)	500 mL Amber Glass	Cool 4ºC	7 Days	500 mL	500 mL
Clopyralid (s)	9 oz Soil Jar	Cool 4ºC	14 Days	50 g	100 g
Creosote(w)	(2) 1 Liter Amber Glass	Cool 4ºC	7 Days	1L	2L
Creosote(s)	Brass Soil Cylinder	Cool 4ºC	14 Days	50 g	100 g
Cyanazine(w)	1 Liter Amber Glass	Cool 4ºC	7 Days	500mL	2L
DBCP(s)	9 oz Soil Jar	Cool 4ºC	14 Days	50 g	100 g
Dioxins(w) – 1613A	1 Liter Amber Glass	Cool 4ºC	1 Year	1 L	1L
Dioxins(s) – 8280/8290	9 oz Soil Jar	Cool 4ºC	30 Days		
Diquat(s)	9 oz Soil Jar	Cool 4ºC	14 Days	20 g	100 g

TEST	CONTAINER	PRESERVATIVE	HOLDING TIME	REQUIRED AMOUNT	PREFERRED AMOUNT
Dual(Metalochlor)	1 Liter Amber Glass	80mg $Na_2S_2O_3$, Cool 4ºC	14 Days		
EDB (non-drinking water)	(3) 40 mL VOA + Travel Blank	Cool 4ºC	14 Days	3 VOA	
EDB(s)	Brass Soil Cylinder	Cool 4ºC	14 Days	50 g	100 g
ETU (w) AB1803	500 mL Amber Glass	Cool 4ºC	7 Days	100 mL	500 mL
Formaldehyde(w)	250 mL Amber Glass	Cool 4ºC	72 Hours	100 mL	250 mL
Formaldehyde(s)	9 oz Soil Jar	Cool 4ºC	7 Days		
Garlon (Triclopyr)	1 Liter Amber Glass	Cool 4ºC	7 Days	500mL	2L
Goal(w)	250 mL Amber Glass	Cool 4ºC	7 Days	50mL	250mL
Glyphosate(s)	9 oz Soil Jar	Cool 4ºC	14 Days	10 g	20 g
Imazapur	500 mL Amber Glass	Cool 4ºC	7 Days	500 mL	500 mL
Imazapur	9 oz Soil Jar	Cool 4ºC	14 Days	50 g	100 g
Methane-Dissolved	(3) 40 mL VOA	HCl Cool 4ºC	14 Days(7Days UnP)	3 VOA	3 VOA
Methane-Total	(3) 40 mL VOA	HCl Cool 4ºC	14 Days(7Days UnP)	3 VOA	3 VOA
MITC(w)	(2) 125 mL VOA	Cool 4ºC	7 Days	2 VOA	
MITC(s)	9 oz Soil Jar frozen with water	Cool 4ºC	14 Days	100 g	300 g
Nemacur(w)	250 mL Amber Glass	Cool 4ºC	7 Days	50mL	100mL
Oust(w)	1 Liter Amber Glass	Cool 4ºC	7 Days	1L	1L
Oust(s)	9 oz Soil Jar	Cool 4ºC	14 Days	75g	100g
Paraquat(s)	9 oz Soil Jar	Cool 4ºC	14 Days	25 g	50 g
PCB(w)	1 Liter Amber Glass	Cool 4ºC	14 Days	500mL	2L
PCB(x)	1 Liter Amber Glass	Cool 4ºC	7 Days	500mL	2L
PCB(s)	9 oz Soil Jar	Cool 4ºC	14 Days	10 g	20 g
PCB (oil)	(1) 40 mL VOA	Cool 4ºC	*	25 drops	
PCP/TCP(w)	125 mL Amber Glass	NaOH, Cool 4ºC	7 Days	10mL	50mL
PCP/TCP(s)	9 oz Soil Jar	Cool 4ºC	14 Days	10 g	20 g
Perchlorate	250 mL Plastic	Cool 4ºC	28 Days	150mL	250mL
Picloram(w)	1 Liter Amber Glass	80mg $Na_2S_2O_3$, Cool 4ºC	7 Days	500mL	2L
Pyrethrins(w)	1 Liter Amber Glass	80mg $Na_2S_2O_3$, Cool 4ºC	7 Days	500mL	2L
Pyrethrins(s)	9 oz Soil Jar	Cool 4ºC	14 Days	20 g	50 g
TPHC-Diesel	(2) 60 mL VOA	Cool 4ºC	14 Days	120mL	120mL
TPHC-Diesel(w) with Sgel	1 Liter Amber Glass	Cool 4ºC	14 Days	400mL	2L
TCLP Diesel(s)	4-Brass Soil Cylinders	Cool 4ºC	14 Days	200 g	250 g
TPHC-Diesel(s)	Brass Soil Cylinder	Cool 4ºC	14 Days	25 g	50 g
TPHC-Gas(w)	(3) 40 mL VOA + Travel Blank	3 drop 1+1 HCl; Cool 4ºC	14 Days	2 VOA	3 VOA
TPHC-Gas(s)	Brass Soil Cylinder	Cool 4ºC	14 Days	20 g	40 g

TEST	CONTAINER	PRESERVATIVE	HOLDING TIME	REQUIRED AMOUNT	PREFERRED AMOUNT
TPHC-Motor Oil(w)	1 Liter Amber Glass	Cool 4ºC	14 Days	500mL	2L
TPHC-Motor Oil(s)	Brass Soil Cylinder	Cool 4ºC	14 Days	25 g	50 g
TPHC-Diesel + Motor Oil	(2) 60 mL VOA	Cool 4ºC	14 Days	120mL	120mL
TPHC-Diesel + Motor Oil(w) with Sgel	1 Liter Amber Glass	Cool 4ºC	14 Days	500mL	2L
TPHC-Diesel + Motor Oil(s)	Brass Soil Cylinder	Cool 4ºC	14 Days	25 g	50 g
TPHC-Solvent(w)	(3) 40mL VOA + Travel Blank	Cool 4ºC	14 Days	500mL+3 VOAs	
TPHC-Solvent(s)	Brass Soil Cylinder	Cool 4ºC	14 Days	50 g	100 g
Tributyltin	1 Liter Amber Glass	Cool 4ºC	none established	1L	1L

TEST	CONTAINER	PRESERVATIVE	HOLDING TIME	REQUIRED AMOUNT	PREFERRED AMOUNT
Acidity(w)	250 mL Plastic	Cool 4ºC	14 Days	50mL	150mL
Alkalinity(w)	250 mL Plastic	Cool 4ºC	Recommend 24 hr, Max 14 days	50mL	150mL
Ammonia(w) without Distillation	250 ml Plastic	H_2SO_4 to pH<2	Recommend7 Day, Max 28 Days	50mL	150ml
Ammonia(w) with Distillation	1 Liter Plastic	H_2SO_4 to pH<2	Recommend7 Day, Max 28 Days	500mL	1L
Ammonia(s)	4 oz Soil Jar	Cool 4ºC	28 Days	1 g	2 g
Asbestos(w)	½ gal Plastic	Cool 4ºC	48 Hours	1L	2L
BOD(w)	½ gal Plastic	Cool 4ºC	24 Hours	500mL	1L
Boron(w)	250 mL Plastic	Cool 4ºC	6 months	250mL	250mL
Bromate	250 mL Plastic	Cool 4ºC	28 Days	100mL	250mL
Bromide	250 mL Plastic	Cool 4ºC	28 Days	100mL	200mL
Chloride(w)	250 mL Plastic	Cool 4ºC	28 Days	50mL	100mL
Chlorine Res.(w)	250 mL Plastic	Cool 4ºC	Immediate	50mL	100mL
Chlorite (sub-test)	500 mL Plastic	Cool 4ºC (sub lab will preserve)	14 Days		
Chloromine, Chlorine, Chlorine Dioxide (sub-test)	500 mL Plastic	Cool 4ºC	24 Hours		
COD(w)	125 mL Amber Glass	$H_2SO_4$to pH<2	Recommend 7 D/Max 28 Days	2mL	5mL
Coliform:					
Presence/Absence	125 mL Plastic Bact.	$Na_2S_2O_3$	20 Hours	100mL	
1X10	125 mL Plastic Bact.	$Na_2S_2O_3$	20 Hours	100mL	
3X5	125 mL Plastic Bact.	$Na_2S_2O_3$	6 Hours	100mL	
Color(w)	250 mL Plastic	Cool 4ºC	48 Hours	50mL	100mL
Conductivity(w)	250 mL Plastic	Cool 4ºC	28 Days	50mL	100mL
Cyanide(w)	500 mL Plastic	NaOH to pH > 12,Cool 4ºC, Ascorbic Acid if chlorine present	14 Days	250mL	500mL
Diss.Oxygen(w)	300 mL Glass BOD Bottle	Cool 4ºC	Immediate	300mL	
Flashpoint(w)	1 L Clear Glass	Cool 4ºC	*	250mL	
Fluoride(w)	250 mL Plastic	Cool 4ºC	28 Days	50mL	100mL
General Mineral:					
GMMins	500 mL Plastic	Cool 4ºC	See Indiv.	350mL	1L
GMMets	250 mL Plastic	HNO_3 to pH<2	6 Months	50mL	100mL
GMMbas	1 L Clear Glass	Cool 4ºC	48 Hours	400mL	2L
General Mineral & Physical:					
GMMins	500 mL Plastic	Cool 4ºC	See Indiv.	350mL	1L
GMMets	250 mL Plastic	HNO_3 to pH<2	6 Months	50mL	100mL

TEST	CONTAINER	PRESERVATIVE	HOLDING TIME	REQUIRED AMOUNT	PREFERRED AMOUNT
GMMbas	1 L Clear Glass	Cool 4ºC	48 Hours	400mL	2L
PHYS	500 mL Amber Glass	Cool 4ºC	See Indiv.	150mL	300mL
Gen Mineral & Inorganic:					
GMINO Mins	500 mL Plastic	Cool 4ºC	See Indiv.	350mL	1L
GMMbas	1 L Clear Glass	Cool 4ºC	48 Hours	400mL	2L
GMINO Mets	500 mL Plastic	HNO_3 to pH<2	6 Months (Hg-28 Days)	250mL	500mL
B & V (Boron & Vanadium)	250 mL Plastic	HNO_3 to pH<2	6 Months	250mL	
Gross Alpha and/or Beta	1L Nalgene	½ mL HNO3	6 Months	1000mL	
Hardness(w)	250 mL Plastic	HNO_3 to pH<2	6 Months	50mL	100mL
Household I:					
HOUMET	250 mL Plastic	HNO_3 to pH<2	6 Months	50mL	100mL
HOUMIN	500 mL Plastic	Cool 4ºC	See indiv.	200mL	500mL
ICAP Metals(w)	500 mL Plastic	HNO_3 to pH<2	6 Months	250mL	500mL
Inorganic with Ext List:					
INOME2	1L Plastic	HNO_3 to pH<2	6 Months (Hg-28 Days)	250mL	500mL
INOMINX	250 mL Plastic	Cool 4ºC	28 Days	50mL	100mL
MBAS(w)	1 L Clear Glass	Cool 4ºC	48 Hours	400mL	2L
Metals(w):					
Dissolved	250 mL Plastic(Hg-500 mL)	Filter then HNO_3 to pH<2	6 Months	300mL	500mL
Total	250 mL Plastic(Hg-500 mL)	HNO_3 to pH<2	6 Months	250mL	500mL
Chromium VI	250 mL Plastic	None	1 Day	50mL	200mL
Low Level Cr6	250 mL Plastic	None	1 Day	50mL	200mL
Lead(dw)	1L Plastic Nalgene	HNO_3 to pH<2	6 Months	250mL	500mL
Mercury(w)	250 mL Plastic	HNO_3 to pH<2	28 Days	100mL	200mL
Mercury(x)	250 mL Plastic	HNO_3 to pH<2	28 Days	50mL	100mL
TCLP,exc. Hg	1 L Plastic	None	180 Days	1L	
TCLP,Hg only	1 L Plastic	None	28 Days	1L	
Metals(s):					
Mercury	9 oz Soil Jar	Cool 4ºC	28 Days	1 g	5 g
Total	9 oz Soil Jar	Cool 4ºC	6 Months	1 g	5 g
Chromium VI	9 oz Soil Jar	Cool 4ºC		2 g	5 g
TTLC	9 oz Soil Jar	Cool 4ºC	6 Months	2 g	5 g
STLC	9 oz Soil Jar	Cool 4ºC	*	50 g	100 g
TCLP,exc.Hg	9 oz Soil Jar	Cool 4ºC	14 D(ext)/ 180 Days	150 g	200 g
TCLP,Hg only	9 oz Soil Jar	Cool 4ºC	14 D(ext)/28 Days	150 g	200 g

TEST	CONTAINER	PRESERVATIVE	HOLDING TIME	REQUIRED AMOUNT	PREFERRED AMOUNT
NFR(TSS)	½ gal Plastic	Cool 4ºC	7 Days	500mL	1L
Nitrite – N (w)	250 mL Plastic	Cool 4ºC	48 Hours	50mL	100mL
Nitrate – N (w)	250 mL Plastic	Cool 4ºC	48 Hours	50mL	100mL
Nitrate+Nitrite	250 mL Plastic	Cool 4ºC	48 Hours	50mL	100mL
Odor	500 mL Amber Glass	Cool 4ºC	6 Hours	50mL	100mL
Oil & Grease-EPA 1664(w)	(2) 1 L Clear Glass	HCl or H_2SO_4 to pH<2	28 Days	1L	2L
Oil & Grease – EPA 1664(s)	Brass Tube	Cool 4ºC	28 Days	50 g	
Organic Lead(w)	500 mL Glass	Cool 4ºC	*	250mL	500mL
Organic Lead(s)	9 oz Soil Jar	Cool 4ºC	*	25 g	50 g
pH	250 mL Plastic	Cool 4ºC	Immediate	50mL	100mL
Phenols	1 L Clear Glass (Plastic OK) + 250 ml Plastic (unpreserv)	$CuSo_4$ prepreserve (H_2SO_4 to pH<2) (large container only)	28 Days	100mL	200mL
Phenols, Low Level – DW (sub test)	(2) 1 liter amber glass	H2SO4 Cool 4ºC DO NOT USE CuSO4!!	28 Days	1L	2L
Phosphate,ortho	250 mL Amber Glass	Cool 4ºC	48 Hours	50mL	150mL
Phosphate,total	250 mL Amber Glass	H_2SO_4 to pH<2	28 Days	50mL	150mL
Redox – water (sub test)	500 mL Plastic	Cool 4ºC	24 Hours	300mL	
Redox – soil (sub test)	4 oz Soil Jar	Cool 4ºC	24 Hours	50 g	
Settleable Solids	½ gal Plastic	Cool 4ºC	24 Hours	1L	2L
Silica (sub test)	250 mL Plastic	Cool 4ºC			
Sulfate	250 mL Plastic	Cool 4ºC	28 Days	50mL	100mL
Sulfide – Dissolved	500 mL Plastic / No Headspace	Cool 4ºC	1 Day	250mL	500mL
Sulfide – Total	500 mL Plastic / No Headspace	Cool 4ºC 5 Drops Zinc Acetate + NaOH	7 days	250mL	500mL
Sulfite	500 mL Plastic	Cool 4ºC	Immediate	50mL	100mL
SWAT Minerals:					
SMMETS	250 mL Plastic	HNO_3 to pH <2	6 Months	50mL	200mL
SMMINS	½ gal Plastic	Cool 4ºC	See indiv.	400mL	1L
SMCOD	250 mL Amber Glass	H_2SO_4 to pH<2	Recommend 7 Days, 28 Days Max	2mL	5mL
SWAT Metals	500 mL Plastic	HNO_3 to pH <2	6 Months	100mL	200mL
Tannins&Lignins	250 mL Plastic	Cool 4ºC	*	20mL	100mL
TDS	250 mL Plastic	Cool 4ºC	7 Days	100mL	200mL
TKN(w)	500 mL Plastic	H_2SO_4 to pH<2	Recommend 7 Days, 28 Days Max	150mL	500mL
TKN(s)	9 oz Soil Jar	Cool 4ºC	28 Days	1 g	5 g

TEST	CONTAINER	PRESERVATIVE	HOLDING TIME	REQUIRED AMOUNT	PREFERRED AMOUNT
TOC(w) - NCL	(2) 40 mL VOA	2 Drops H_3PO_4	28 Days	1 VOA	2 VOA
TOC(w) – Alpha	125 mL VOA	HCl	28 Days	1 VOA	2 VOA
TOC(w) – Sierra Foothills	125 mL VOA	H_2SO_4	28 Days	1 VOA	2 VOA
Total Solids	500 mL Plastic	Cool 4ºC		80 mL	
TOX(w)	(2) 125 mL VOA	H_2SO_4	N/A	2 VOA	
Turbidity	250 mL Plastic	Cool 4ºC	48 Hours	25mL	50mL

BIOASSAYS

TEST	CONTAINER	PRESERVATIVE	HOLDING TIME	REQUIRED AMOUNT	PREFERRED AMOUNT
% Survival	2 gallons Plastic	Cool 4ºC	36 Hours	2 gals	2 gals
% Survival Renewal	2 gallons Plastic x 2	Cool 4ºC	36 Hours	2 gals x 2	2 gals x 2
Hazardous Waste Screen (w)	1 liter	Cool 4ºC	none established	1L	1L
Hazardous Waste Screen (s)	9 oz Soil Jar	Cool 4ºC	none established	100g	100g
Hazardous Waste Defin. (w)	1 liter	Cool 4ºC	none established	1L	1L
Hazardous Waste Defin. (s)	9 oz Soil Jar	Cool 4ºC	none established	100g	100g
LC50	5-6 gallons – Plastic	Cool 4ºC	36 Hours	5 gal	6 gal

APPENDIX L
SAMPLE WORK ORDER

North Coast Laboratories, Ltd.

WORK ORDER Summary

Company: Credit Card Customer
All charges have been paid. Release report

26-Oct-99

Work Order 9910476

Client ID: CCCUSREP
Project: Site 1, Site 2, Old Site
QC Level:

Contact:

Comments:

Sample ID	Client Sample ID	Collection Date	Date Received	Date Due	Matrix	Test Code	Storage
9910476-01A	Site 1	10/23/99	10/25/99	11/4/99	Aqueous	TANLIW	SEC
9910476-02A	Site 2	10/23/99	10/25/99	11/4/99	Aqueous	TANLIW	SEC
9910476-03A	Old Site	10/23/99	10/25/99	11/4/99	Aqueous	LPPCPWE	2-Red
		10/23/99	10/25/99	11/4/99	Aqueous	PCPTW	2-Red

APPENDIX M
CLIENT REPORT

November 04, 1999

Credit Card Customer
All charges have been paid.
Release report to client.

Order No.: 9910476
Invoice No.: 2729
PO No.:

Attn: Patrick Mumford

RE: Site 1, Site 2, Old Site

SAMPLE IDENTIFICATION

Fraction	Client Sample Description
01A	Site 1
02A	Site 2
03A	Old Site

REPORT CERTIFIED BY

Laboratory Supervisor(s)	QA Officer	Jesse G. Chaney, Jr. Laboratory Director

NORTH COAST LABORATORIES
5680 West End Road • Arcata, California 95521-9202 • 707-822-4649 • FAX 707-822-6831

Date: 04-Nov-99
WorkOrder: 9910476

ANALYTICAL REPORT

Client Sample ID: Site 1 **Received:** 10/25/99 **Collected:** 10/23/99 0:00
Lab ID: 9910476-01A

Test Name: Tannin and Lignin **Reference:** SM 5550B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Tannin and Lignin	0.17	0.10	mg/L	1.0		10/26/99

Client Sample ID: Site 2 **Received:** 10/25/99 **Collected:** 10/23/99 0:00
Lab ID: 9910476-02A

Test Name: Tannin and Lignin **Reference:** SM 5550B

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Tannin and Lignin	0.14	0.10	mg/L	1.0		10/26/99

Client Sample ID: Old Site **Received:** 10/25/99 **Collected:** 10/23/99 0:00
Lab ID: 9910476-03A

Test Name: Penta, tetrachlorophenol **Reference:** Canadian Pulp Report

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Tetrachlorophenol	ND	1.0	µg/L	1.0	10/27/99	10/30/99
Pentachlorophenol	0.35	0.30	µg/L	1.0	10/27/99	10/30/99
Surrogate: Dibromophenol	98.9	81-116	% Rec	1.0	10/27/99	10/30/99

NORTH COAST LABORATORIES
5680 West End Road · Arcata, California 95521-9202 · 707-822-4649 · FAX 707-822-6831

APPENDIX C-3

QUALITY ASSURANCE MANUAL-ALTA ANALYTICAL LABORATORY

ALTA

QUALITY MANUAL

HRMS SERVICES

Approved By:

William J. Luksemburg, *President*

Reviewed By:

Kathleen P. Dewhirst, *Quality Assurance Officer*

Effective Date:
April 2005

Additional Approved Signatories:

Martha M. Maier, *Director of HRMS Services*

James M. Hedin, *Principal Scientist*

Alta Analytical Laboratory Inc.
1104 Windfield Way
El Dorado Hills, CA 95762
FAX (916) 673-0106
(916) 933-1640

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FOREWORD

The Quality Manual (QM) describes the Quality System implemented for the HRMS Services group at Alta Analytical Laboratory Inc. (ALTA), El Dorado Hills, California. The policies and procedures outlined in this QM are designed and developed to comply with the established NELAC Standards. It is the intent of ALTA to meet or exceed the Quality Assurance/Quality Control (QA/QC) requirements set by NELAC, the USEPA or other appropriate governmental or private entities to assure that all analytical data generated are scientifically valid, defensible, comparable and of known acceptable precision and accuracy.

The QM shall be amended to reflect any changes to ALTA's capability, location or Quality System. The Quality Assurance Unit (QAU) is responsible for the maintenance and annual review of the QM.

1. Introduction

Alta Analytical Laboratory Inc. (ALTA), El Dorado Hills, CA was established in 1990 and is a privately owned California corporation. ALTA provides state-of-the-art mass spectrometry services to chemical manufacturers, environmental engineering firms, and the pulp and paper industry as well other industrial and governmental clients. ALTA operates with the intent of providing data of the highest quality with responsive service in a short turnaround time.

ALTA has an expanding national and international client base attributable to its reliable reputation in performing difficult trace level analyses. ALTA's expertise lies in the analysis of semivolatile organic compounds such as Dioxin/Furans (PCDD/PCDF), Polynuclear Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs), Polychlorinated Naphthalenes (PCNs), Hexachlorobenzene (HCB), Hexachlorocyclopentadiene (HCP), and Polybrominated Diphenyl Ethers (PBDEs).

1.1 Policy

It is the policy of ALTA to meet the specific quality requirements and to satisfy the needs of the client, the regulatory authorities or organizations providing recognition throughout data generation and process operations. A Quality System has been established to achieve this policy. The system encompasses all of the applicable elements of the established NELAC Standards. It is ALTA's intent to provide full compliance with this Quality System throughout all phases of client services and to ensure that only an acceptable final product is presented to the client.

1.1.1 It is Management's responsibility to instill a commitment of the quality standards throughout the company, and to ensure each employee has a clear understanding of the Quality System.

- Quality is the responsibility of all ALTA employees.
- All Alta employees must comply with all QA/QC procedures as it pertains to their function.
- All employees shall be accountable for the quality of their individual assignments and functional responsibilities.
- Employees shall be responsible for reporting any non-conformance to Management or the QAU.
- The laboratory shall have sufficient personnel with necessary education training, technical knowledge and experience for the assigned positions.

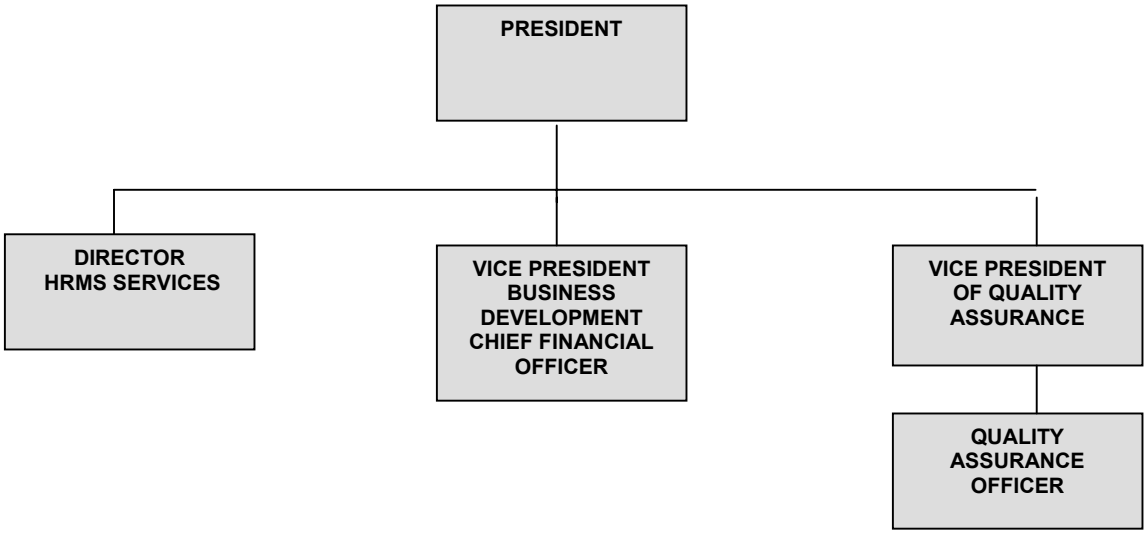
1.1.2 Management is responsible to ensure personnel are free from any commercial, financial, and other undue pressures, which might effect the quality of work.

1.1.3 All Alta employees shall be confident in their independence of judgement and maintain integrity at all times.

2. Laboratory Organization and Facilities

The management staff of ALTA consists of a Laboratory President and five Vice Presidents. In the absence of the Laboratory President, one of the Vice Presidents will be named as interim successor. Any of the five Vice Presidents can fulfill the responsibilities of the remaining Vice Presidents.

The organization and management structure of the HRMS Services group is shown in the following organizational chart.



2.1 The following are summaries of the responsibilities of the key management positions shown on the preceding organization chart.

2.1.1 Laboratory President

The Laboratory President is responsible for the management of financial/technical operations, as well as implementation of corporate goals, objectives and policies and review of laboratory operations. This includes directing the routine analysis and method development work and overseeing marketing of HRMS services.

2.1.1.1 Vice President Business Development Chief Financial Officer

The VP of Business Development Chief Financial Officer is responsible for all financial and facility services. The management of the facility includes overseeing building maintenance. The VP of Business Development Chief Financial Officer supervises all administrative personnel.

2.1.1.2 Vice President of Quality Assurance

The Vice President of Quality Assurance is responsible for the overseeing the Quality Assurance Unit. The VP of Quality Assurance ensures that the QAU is in compliance with applicable federal, state, and other agencies regulations.

2.1.1.3 Director of High Resolution Mass Spectrometry (HRMS) Services

The Director of High Resolution Mass Spectrometry Services (HRMS) manages the production scheduling and client management for the HRMS Services group, is responsible for final review and interpretation of analytical data and final reports, and also servers as technical director.

2.1.1.4 Quality Assurance Officer

The QAO is responsible for managing the QA activities of the entire laboratory. The QAO reports directly to the Vice President of Quality Assurance. The QAO serves as the focal point for QA/QC. The QAO is responsible for the oversight and/or review of quality control data. When QA oversight is necessary, the QAO functions must be independent from the laboratory operations. The QAO works with management to ensure that the ALTA QM and associated SOPs and APs are followed as written. QAO maintains a position that is free from outside influence in order to evaluate the data and perform all other QAO responsibilities objectively.

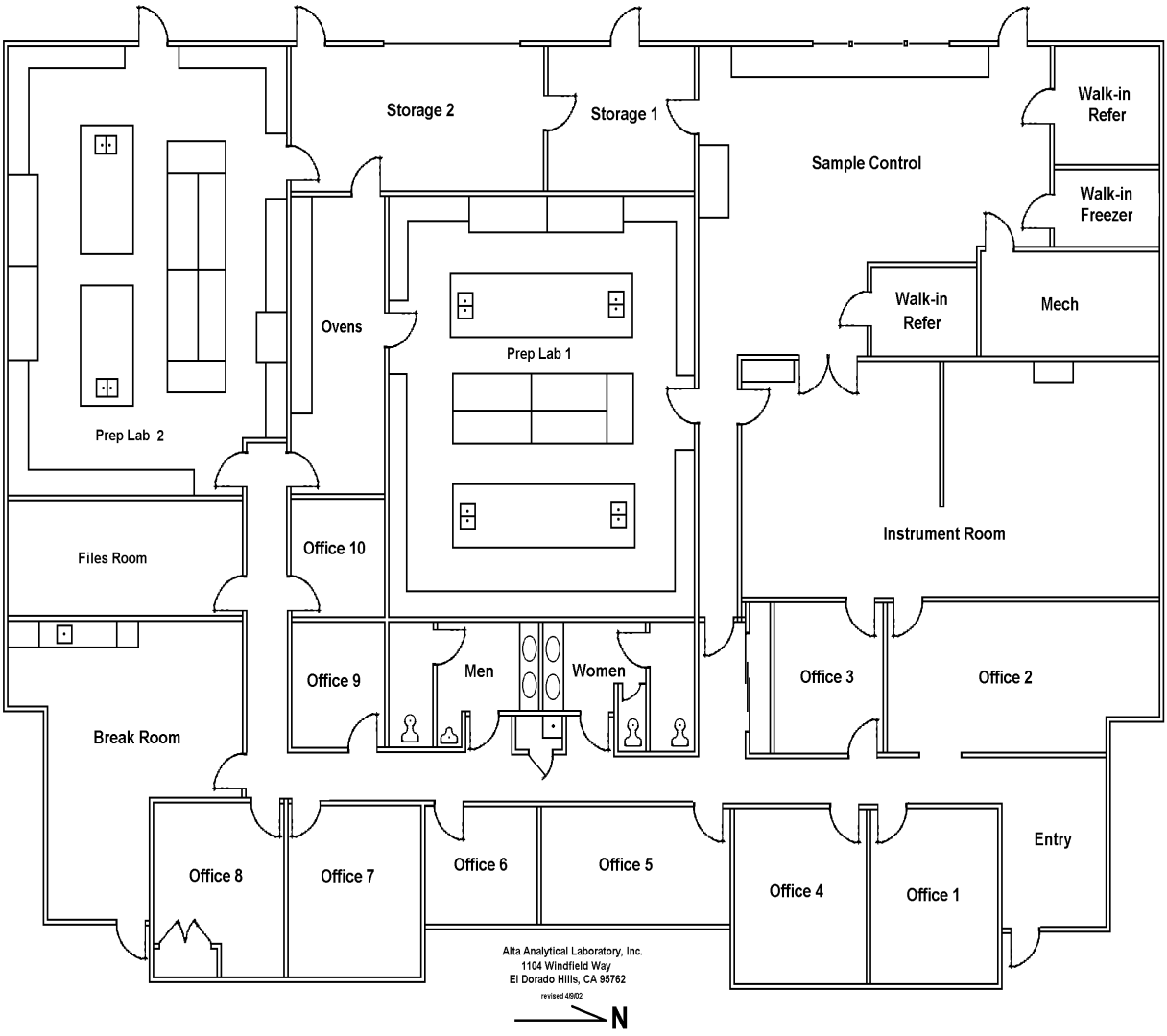
2.1.2 Approved signatories include the laboratory President, the Director of HRMS Services and the Principal Scientist. These responsible parties are listed on the QM title page.

2.2 Facilities

2.2.1 ALTA Analytical Laboratory operates from El Dorado Hills, CA. The facility for the HRMS department consists of 9,000 square feet.

2.2.2 The facility has been constructed and maintained to ensure that results are not invalidated or do not adversely affect the required accuracy of measurement.

2.2.3 Layout – 1104 Windfield Way, El Dorado Hills, CA



3. Quality System

The Quality System applies to the HRMS Services operations of the company.

The company's Quality System is designed to comply with the applicable requirements of NELAC Standards and to satisfy the needs of the client or organization providing recognition. All policies, systems, and procedures are documented to assure quality of the data. Personnel shall familiarize themselves with quality documentation and implement the policies and procedures in their work. Figure 3.1 shows a hierarchy of Quality Documents used at Alta Analytical Laboratory.

Senior Management will review the effectiveness and suitability of the Quality System at least annually. The reviews shall address issues that impact quality. The results of the reviews shall be used to design and implement improvements to the system. The reviews include reports from management and supervisory personnel, recent internal audits, external audits, proficiency testing, client feedback, and corrective action reports. Records of the review meeting findings and corrective actions will be maintained by the QAU.

3.1 Quality Documents

3.1.1 The Quality System is outlined and documented in the Quality Manual and supporting quality documents. The documented quality system assures that services provided to clients comply with specified quality criteria.

3.1.2 The Quality Manual contains Quality Policies covering the applicable requirements of the NELAC quality standard.

3.1.3 Program specific quality criteria are specified in the Quality Assurance Program Plan (QAPP).

3.1.4 Procedural activities that affect quality are described in more detail in the Standard Operating Procedures (SOPs) and Analytical Procedures (APs).

3.2 Use of Quality Documents

3.2.1 Management will review and approve all quality documents prior to issuance. All quality documentation shall be communicated to, understood by, available to, and implemented by the appropriate personnel.

3.2.2 A QAPP or other project-specific requirements submitted by the client will be reviewed to determine whether they are within the scope of the Analytical Procedures. Any discrepancies will be discussed with the client and documented prior to commencement of the project.

3.2.3 The Quality Manual will be understood and implemented throughout the company. The QAPP, SOPs and APs will be understood and implemented throughout applicable operations.

3.2.4 Quality documents shall be periodically reviewed to ensure continuing suitability and compliance with applicable requirements. The Quality System will be reviewed on an ongoing basis and revised as needed to ensure that it effectively encompasses the company's quality criteria. The Quality Manual will be maintained by the QAU. Revisions to the Quality Manual may be made by replacing individual policies or the entire manual.

3.2.5 Any departures from policies or planned activities that affect quality will be approved by management prior to occurrence.

3.2.6 The QAPP will be maintained by the designated responsible manager, or the QAU. Revision may be made to individual sections of the entire plan.

3.2.7 Standard Operating Procedures will be maintained as designated in the specific SOP with revisions being made on an as needed basis.

3.3 Document Control

Standard Operating Procedures (SOP) and Analytical Procedures (AP) or any documents that specify quality requirements or otherwise affect quality are Controlled Documents. All controlled documents will be prepared, issued and revised in accordance with the applicable SOPs. The SOPs and APs are presented in Table 3.2 and 3.3, respectively.

3.3.1 Procedures are established to control and maintain the issue, distribution, and revisions of all controlled documentation.

3.3.2 Appropriate documents shall be made available at all locations where operations essential to the effective functioning of the laboratory are performed.

3.3.3 Complete and current copies of the controlled documents shall be made available upon issuance, and obsolete copies will be removed

from all points of issue or use. The controlled document copies will be stamped, in red, as an "Official QA Copy".

3.3.4 All original controlled documents are archived by QAU.

3.3.5 A master list will be used to ensure that the correct revision of each SOP, and AP is available for use, and that obsolete revisions are removed from service. Each controlled document has an associated revision number and effective date to enable tracking of current revisions.

3.3.6 Document changes are subjected to review and approval by the appropriate personnel.

3.3.7 Documents are periodically reviewed and, where necessary, revised to ensure continuing suitability and compliance with applicable requirements. The Quality Manual (QM) will be revised as needed and reviewed annually.

3.3.8 Records of revisions for Controlled Documents and the QAPP will be maintained by QAU.

Figure 3.1 The Hierarchy of HRMS Quality Documents

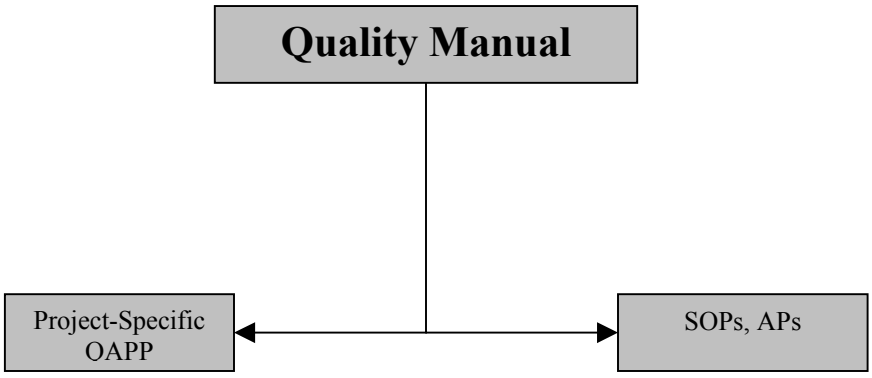


Table 3.2 List of Standard Operating Procedures

SOP Number	Title
1A	Organizational Structure
1B	Security
1C	Personnel Adminstration
1D	Laboratory Inspections-External
2A	Safety Orientation
2B	Chemical Hygiene Plan
2C	Protective Clothing and Equipment
2D	Waste Disposal
2E	Glassware Preparation
3A	Writing Standard Operating Procedures
3B	SOP Preparation and Maintenance
7A	Raw Data Interpretation and Maintenance
7B	Standard Laboratory Reports
7D	Significant Figures and Arithmetic Operations
7E	Storage of HRMS Laboratory Reports
7F	Review of Data Packages
7H	Corrective Action Report
7I	Handling Client Complaints
7J	Client Services
7K	HRMS Services
7L	Instrument Raw Data Backup and Archive Procedures
7M	Data Corrections
8A	Responsibilities of QAU
8B	QAU Records
8C	Standard Operating Procedures
8D	QAU Master Schedule Sheet
8E	Protocol Review and Maintenance
8F	Study Inspections
8G	Procedures for Conducting Inspections
8H	Final Analytical Report Audits
8I	GLP Archives
8J	Facility Inspection
8L	Control Charts
9A	Instrument Maintenance Logbooks
9AAA	Refrigerators/Freezers for HRMS
9B	Balances
9C	Constant Temperature Oven (VWR 1320)
9E	N-Evap
9F	Roto-Evaporator
9G	Thermometers

SOP Number	Title
9J	Initial and Continuing Calibration Procedures for HRMS Services
9N	Centrifuges
9OO	Zymark Turbovap 96 Concentration Workstation
9Q	Electronic Digital Thermometer
9QQ	Zymark Turbovap II Evaporator
9R	Bransonic 1200 Ultrasonic Cleaner
9RR	Dionex ASE 300 Accelerated Solvent Extractor
9U	Drummond Microdispenser
9UU	Equipment Compliance Program
9V	GAST 2Z866 Compressor/Vacuum Pump
9VV	Misonix Sonicator 3000 Ultrasonic Liquid Processor
9W	Multi-tube Vortex Mixer
9WW	Micromass Autospec Ultima HRMS Operation
9XX	HRMS Instrument Maintenance Schedule
10A	Security and Safety
10B	Sample Receiving and Log-In Procedures
10C	Sample Tracking, Shipping and Return
10D	Maintenance Procedures in Sample Control
10E	Client ID Designation
10F	Pest Control
10H	Consignment Tracking
10I	Bottle Order Preparation
11B	Management of Analytical Standards
11C	Quality Control Procedures for HRMS Services
11D	Glassware Cleaning by Furnace
11E	Sample Holding Times and Storage Conditions
11F	Laboratory Benchsheets
11G	Method Detection Limits
11H	Determination of Percent Solids
11I	Laboratory Reagents Preparation and Documentation
11J	Manual Integrations
11K	Accomodations and Environment
12A	Security Procedures
12B	System Backup Procedures
12C	System Maintenance
12D	System Validation Procedures
12E	Computer Operations
12F	Computer Media Archives
12G	Disaster Prevention and Recovery
12H	Change Control Procedures
13A	General Program

SOP Number	Title
13B	Exposure Determination
13C	Universal Precaution Guidelines
13D	Equipment Service and Decontamination
13E	Employee Training and Recordkeeping
13F	HBV Vaccination and Exposure Incident Reporting
13H	Spill Clean up
13J	Routine Cleaning and Disposal
*	Gaps represent SOPs pertaining to the LCMS department.

Table 3.3 List of Analytical Procedures

AP No.	Title
1A	Sample Prep of MM5 Trains for Analysis of PAHs, Trichlorobenzene and Hexachoroethane
1B	Prep and Analysis of PUF Sample for PAHs by CARB 429
1C	Prep and Analysis of MM5 Trains for PCBs by CARB 428 and Method 23 or 0023A
1CC	Prep and Analysis of MM5 Trains for PCDD/F/PCB/PAH by EPA Method 0023A/CARB 428/CARB 429
1D	Prep and Analysis of PUF Samples for PCBs by CARB 428
1E	Prep and Analysis of MM5 Trains for PCDD/F by CARB 428 and Method 23 or 0023A
1F	Prep and Analysis of PUF Samples for PCDD/F by Method TO-9
1FF	Prep and Analysis of Sampling Trains, PUFs, PUF/XAD2 by Modified Method 1668
1G	Prep and Analysis of MM5 Trains for PCDD/F/PCB/PAH by CARB 428 and CARB 429
1GG	Prep and Analysis of Sampling Trains, PUFs/PUF/XAD2 by Modified Method 1614
1H	XAD2 Resin Preparation
1I	Prep and Shipping of XAD2 Resin Modules and Filters for Field Use
1L	Prep and Analysis of MM5 Train PCDD/F/PCB/8270/Pesticides Tetrachlorobenzene by CARB 428
1M	Prep and Shipping of PUF Cartridges and Filters for in Field Use
1N	PUF Preparation
1O	Sample Prep of MM5 Train for Analysis of PCDD/F/PAH/PCB/8270
1Q	Prep and Analysis of MM5 Train for PAHs and Phenol by CARB 429
1R	Prep and Analysis of PUF Samples for PCDD/F/PCB/PAHs by CARB 428 and CARB 429
1S	Prep and Analysis of MM5 Train for PAHs by CARB 429
1T	Prep and Analysis of Modified 680 Sampling Trains for PCBs by Method 680
1U	Prep and Analysis of MM5 Train for PCBs and PCDD/F by CARB 428 and Method 23 or 0023A
1V	Prep and Analysis of MM5 Train for PCDD/F/LRPCB/8270 by Method 23A and CARB 428
1W	Prep and Analysis of MM5 Train for PCBs and 8270 by CARB 428
1X	Prep and Analysis of MM5 Train for PCDD/F, PAH and 8270s by Method 23A
1Y	Prep of PUF Samples for Analysis of PCDD/F Using HRMS & PAHs by 8270 Full Scan
1Z	Sample Prep of PUF Samples for Analysis of PUF Samples for PCDD/F by EPA Method TO9 for the State of Connecticut
2B	Sample Extract Cleanup Options
2C	Coplanar PCBs in Soil and Sediments
2D	Sample Extract Cleanup in Oil Samples
2E	USEPA Method 8280A
2F	USEPA Method 8290
2H	Modified Method 8290 for the Extraction and Analysis of PCDD/F and Coplanar PCBs in Human Breast Milk
2I	Modified Method 8290 for the Extraction & Analysis of PCDD/F & COP PCBs in Human Plasma
2J	Total Suspended Solids

AP No.	Title
2L	Reagent Preparation
2M	Extraction and Analysis of Fish/Tissue Samples by USEPA Method 8290
2N	Prep of Aqueous Samples for TCDD by Modified USEPA Method 613
2P	USEPA Method 1613B
2Q	Temporary Manual for Analysis of Dioxin & PCB Blood Samples
2R	Sample Extraction Options
2S	Method 1625B
2T	Modified Method 8290 for PCDD/F and PCBs in Blood
2U	PBDD/F by Method 8290
3B	Prep of Aqueous Samples for PAHs by Modified USEPA Method 8270
3C	Prep of Fish Samples for PAHs by Modified USEPA Method 8270
3D	Modified Method 1668
3F	Extraction & Analysis of PBDE in Environmental Samples
3H	Analysis of PCNs by Modified EPA Method 1668A
4A	Method 8290/1668 for PCDD/F and PCBs in Blood for UofM
4B	Method 8290/1668 for PCDD/F and PCBs in Soil and Dust for UofM
4C	Method 1668 for Total PCBs in Blood, Soil and Dust for UofM
4D	Method 8290 for the analysis of PCDD/PCDF,s and Method 1668 for coplanar/mono-ortho PCB,s in Human Serum

3.4 Quality Assurance Objectives and Quality Control Procedures

Quality assurance objectives employed at ALTA provide routine mechanisms of ongoing control and evaluation of measurement data quality. The quality control (QC) procedures routinely followed evaluate method performance in terms of accuracy and criteria specified by the method or protocol.

3.4.1 Accuracy and precision

Accuracy and precision objectives for HRMS analyses are listed in Table 3. ALTA's internal quality control procedures include the analysis of method blanks, duplicate samples, laboratory control samples, and matrix spikes.

3.4.2 Definitions

3.4.2.1 Accuracy: Accuracy is the nearness of a measurement to the true or theoretical value. Accuracy is assessed by determining recoveries from laboratory control samples, matrix spikes or by comparing values obtained from reference samples.

3.4.2.2. Analytical Batch: An analytical batch is a set of samples of the same matrix which are analyzed together using the same method, reagents, and standards. QC results associated with individual analytical batches such as ongoing precision and recovery samples, laboratory control samples, method blanks, matrix spike samples, and duplicate samples are evaluated together to assess data quality. Each batch will be assigned a unique batch number, which will be used to associate sample results with quality control data. All samples associated with a particular batch must be extracted on the same day.

3.4.2.3 Clean-up Recovery Standard: A clean-up recovery standard is a reference substance that is an isotopically labeled analyte that is added to the sample extract prior to any clean-up procedures. This standard is used to quantitatively assess losses occurring throughout the clean-up process.

3.4.2.4 Control/Warning Limits: Warning and control limits are limits used in laboratory control charts tracking average recovery and relative percent difference. For a Means Chart, typical warning and control levels are ± 2 and ± 3 standard deviations (s) from the central line (i.e., average mean recovery), respectively. Similarly, the warning and

control limits for a RPD Chart are usually set at + 2s and + 3s above the mean RPD, respectively.

3.4.2.5 Detection Limit (DL): The lowest concentration of an analyte within an environmental matrix that a method or equipment can detect.

3.4.2.6 Duplicate Sample (DS): Duplicate samples are two separate aliquots taken from the same source. Duplicate samples are analyzed independently to assess laboratory precision.

3.4.2.7 Estimated Maximum Possible Concentration (EMPC): The EMPC is calculated when the response has a S/N in excess of 2.5, but the ion abundance criteria are not met.

3.4.2.8 Internal Standards(IS): An internal standard is a reference substance that is an isotopically labeled analyte which is added to the sample prior to extraction and used in the quantitation and identification of native analytes.

3.4.2.9 Laboratory Control Sample (LCS1/LCS2): A laboratory control sample is prepared by adding a known quantity of native standards to an interferant free matrix.

3.4.2.10 Method Blank (MB): A method blank is a sand, XAD or deionized water preparation that is free of native analyte or interferants that has been prepared and analyzed using the same procedures followed for the rest of the analytical batch. The method blank is used to determine the level of background laboratory contamination, if present.

3.4.2.11 Method Detection Limit: The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero in the matrix tested. MDLs follow 40 CFR Part 136.

3.4.2.12 Method Quantitation Limit (MQL): The method quantitation limit is defined as the quantity of native analyte that corresponds to the lowest concentration of the calibration curve. The Method Quantitation Limit is also know as the Reporting Limit.

3.4.2.13 Matrix Spike (MS/MSD): A matrix spike sample is prepared by adding a known quantity of native standards to a sample matrix prior to extraction. Matrix spike concentration levels will vary according to the matrix encountered and study objectives.

3.4.2.14 Native Standard: A native standard is a reference substance that is a non-isotopically labeled analyte. Native standards are used in conjunction with internal standards to determine response factors and quantitatively assess accuracy.

3.4.2.15 Ongoing Precision and Recovery (OPR): A laboratory blank spiked with known quantities of analytes. The OPR is analyzed exactly like a sample. Its purpose is to assure that the results produced by the laboratory remain within the specified limits.

3.4.2.16 Precision: Precision is the agreement between a set of replicate measurements. RPD is used as the principal measure of precision and is based on the analysis of duplicate quality control samples.

3.4.2.17 Pre-Spike Standards: A pre-spike standard is an isotopically labeled analyte that is spiked into an MM5 resin cartridge or PUF prior to sampling. The recoveries of pre-spike standards provide a measure of the air sampling efficiency for native analytes.

3.4.2.18 Quality Control Sample: Quality control samples are analyzed to access the various aspects of the analytical process in order to monitor quality within the laboratory. The most frequently used QC samples are method blanks, duplicates, matrix spikes, matrix spike duplicates and LCS pairs.

3.4.2.19 Recovery Standard: A recovery standard is a reference substance that is an isotopically labeled analyte which is added to the sample extract after clean-up and prior to injection. This standard is used to quantitatively assess the absolute recoveries of the internal and clean-up recovery standards.

3.4.2.20 Resin QC: A resin QC is an XAD-2 preparation that is analyzed to assess possible background contamination originating from the resin.

3.4.2.21 Reporting Limit: See Method Quantitation Limit.

3.4.2.22 Signal to Noise Ratio: Dimensionless measure of the relative strength of an analytic signal to the average strength of background instrument noise.

3.4.3 Calculations

3.4.3.1 Percent Recovery (%R): Percent recovery is a measure of accuracy and is calculated according to the following expression:

$$\%R = \frac{(Amount\ Found)}{(Amount\ Spiked)}\ X\ 100$$

3.4.3.2 Relative Percent Difference (RPD): Percent Recovery (%R) from duplicate LCS or matrix spike analyses are used to calculate RPD using the following expression:

$$RPD\ =\ \frac{|\%R_1 - \%R_2|}{\left(\frac{(\%R_1 + \%R_2)}{2}\right)}\ X\ 100$$

3.4.3.3 Similarly, the RPD for duplicate sample analyses, is calculated using the sample concentration (C), as follows:

$$RPD_{DS} = \frac{|C_1 - C_2|}{\frac{(C_1 + C_2)}{2}} x100$$

3.4.3.4 Relative Standard Deviation (RSD): Also known as the coefficient of variation.

$$RSD = \frac{SD}{Mean} \times 100$$

3.4.4 Quality Control Procedures

3.4.4.1 Method Blanks:

3.4.4.1.1 A method blank is run with each analytical batch or 20 samples (whichever is less) per method and matrix type.

3.4.4.1.2 For any method involving the determination of native 2,3,7,8-substituted isomers except hepta- or octa-PCDD/PCDF, the levels measured in the method blank must be less than the MQL, or ten times lower than the concentration found in samples within the analytical batch.

3.4.4.1.3 All samples within an analytical batch are re-extracted and analyzed if the method blank associated with that batch does not meet internal standard recovery criteria or contamination limits specified above. Otherwise, the data is qualified appropriately.

3.4.4.2 Ongoing Precision and Recovery/Laboratory Control Samples

3.4.4.2.1 A single OPR or ***a pair of LCS*** is analyzed with every batch of clients' samples.

3.4.4.2.2 All samples within an analytical batch are re-extracted and analyzed if the native or internal standard recoveries from the LCS do not fall within the acceptable control range for accuracy or if the RPD falls outside the specified precision limit established by the method. If the OPR/LCS is not within the acceptable control range and the analytes are not detected in the samples, then it is at the discretion of the Director of HRMS to re-extract the QC sample or qualify the data that is reported.

3.4.4.3 Matrix Spike and Duplicate Sample Analyses

3.4.4.3.1 An MS, MS/MSD, or duplicates are analyzed upon client request, method requirements, or at the discretion of the Director of HRMS.

3.4.4.3.2 If the RPD from duplicate field samples exceeds 20% or the MS/MSD exceeds 25%, corrective action will be

taken as directed in the method (e.g., EPA Method 8290).

3.4.4.3.3 If the RPD from sample duplicate analyses is greater than 50% then both duplicate samples will be an indication that further action may be necessary.

3.4.5 Quality Control Charts

Quality control data are calculated on a quarterly basis by the QAU and distributed to the Director of HRMS Services for review. A set of current QC control charts is maintained in QAU to monitor QC trends on a real time basis. Original copies of the QC charts and any associated tabular data are stored in QAU. QC control charts are available upon written request of clients or regulatory agencies or may be viewed during facility audits. Parameters for control charts are outlined in SOP 8L.

Table 3.0 Accuracy and Precision Objectives

DATA ACCEPTANCE/REJECTION CRITERIA Precision/Accuracy and QC Requirements					
METHOD	**Internal Standard Recovery Limits**	**OPR Native Spike Recovery Limits Reported as (ng/ml)**	**Duplicate Sample Analysis**	**MS/MSD**	OTHER
EPA 8280/ 8280A	25-150%	70-130%	If requested by client RPD≤50%	If requested by client RPD≤25%	Method Blank 1 for every extraction batch (5%) up to 20 samples ≤MDL, report in ng/g or ng/L ≤5% regulatory limit or level of analyte in sample
EPA 8290/0023A	40-135%	70-130%	If requested by client RPD≤25%	If requested by client RPD≤20%	Method blank required between calib.run and 1st sample (ONLY for 0023A)
EPA 23	Surrogate 70-130% IS=Tetra-Hexa40-130% Hepta-Octa=25-130%	70-130%	Not applicable	Not applicable	Follow Method criteria of 8290
T0-9A	Surrogate 70-130% IS=Tetra-Hexa 50-120% Hepta-Octa=40-120%	70-130%	Not applicable	Not applicable	Follow Method criteria of 8290
EPA 613	25-150%	70-130%	If requested by client RPD≤50%	(MS only) 10% of all samples or 1 per month (whichever is greater	Method Blank 1 for every extraction batch (5%) up to 20 samples
EPA 1613A **EPA 1613B**	See Table 7 For Tetra thru Octa Table 7A for Tetra only	See Table 6 For Tetra thru Octa Table 6A for Tetra only	If requested by client RPD≤50%	If requested by client RPD≤50%	Method Blank 1 for every extraction batch up to 20 samples (5%). Must be immediately after OPR Must be ≤ 1/3 of minimium level (10pg/L or regulatory compliance level whichever is greater).
EPA 1668	Samples = 25-150% OPR Recovery per Table 7 Alta AP No. 3D	OPR Recovery per Table 7 Alta AP No. 3D	If requested by client RPD≤50%	If requested by client RPD≤50%	Method Blank 1 for every extraction batch up to 20 samples (5%). Must be ≤ 10x amount found in sample.
NCASI 551	40-120% or S/N >10:1 if %rec.is >20% with qualifier "H"	70-130%	If requested by client RPD≤50%	If requested by client RPD≤50%	Method Blank IS & RS Recovery >40%
CARB 428 PCB's	40-120% or S/N >10:1	60-140%	Not applicable	Not applicable	Method Blank with every extraction batch See Method 1668

Table 3.0 Accuracy and Precision Objectives

DATA ACCEPTANCE/REJECTION CRITERIA Precision/Accuracy and QC Requirements					
METHOD	**Internal Standard Recovery Limits**	**OPR Native Spike Recovery Limits Reported as (ng/ml)**	**Duplicate Sample Analysis**	**MS/MSD**	OTHER
CARB 428 D/F	Surrogates= 60-140% IS= 40-120% or S/N >10:1	60-140%	Not applicable	Not applicable	Method Blank with every extraction batch Must be ≤ MDL
CARB 429	50-150% or signal to Noise > 10:1 with qualifier "H"	Field Spikes 50-150%	If requested by client RPD≤50%	Not applicable	Method Blank with every extraction batch Must be ≤ 5% conc. in sample
EPA 1614 (DRAFT)	Tetra-Hepta: 30-140% Tetra-Hepta:25-150% Samples Deca: 20-200%	Tetra-Hepta: 50-150% Deca: 40-200%	If requested by client RPD≤50%	If requested by client RPD≤25%	Method Blank ≤ML; ≤1/3 regulatory limit or level of analyte in sample
Mod 1668A (PCN)	30-140% 25-150% Samples	50-150%	If requested by client RPD≤50%	If requested by client RPD≤25%	
HCB/HCP Method 1625	See Table 8 in Method	See Table 8 in Method	If requested by client RPD≤50%	If requested by client RPD≤25%	

4. Purchasing

4.1 Quality Materials and Services

Materials and services that affect the quality of the company's services will be designated as quality material and services. Purchases shall be made only from approved suppliers (based on historical experience or quality certifications).

4.2 Control of Quality Materials and Services

Quality Materials and Services and, where appropriate, potential suppliers' Quality Systems, shall be evaluated to ensure that specified quality requirements are met. Any purchased equipment and consumable materials, whenever possible, shall be inspected, calibrated, or otherwise verified as complying with any standard specifications relevant to the calibrations or tests concerned prior to use. Records of actions taken to check compliance shall be maintained.

4.3 Procurement Documents

Procurement documents will clearly specify all information and requirements necessary to ensure that the correct materials and services are purchased and received. Any discrepancies between request and contracts shall be resolved before any work commences. Request and contracts shall be reviewed to determine the effect of financial, legal and time schedule aspects. Any amendments to the request or contract after work has commenced shall require another review process

5. Sample Control

Samples and other material received from clients shall be handled and maintained in accordance with laboratory SOPs.

5.1 Receipt of Materials

5.1.1 Samples and materials received from clients, and any other materials received from an outside source in the regular course of business, will be inspected upon receipt to insure that they meet specified quality requirements. All conditions, including any abnormalities or departures from standard conditions, shall be recorded according to SOPs.

5.1.2 Immediately after inspection samples will be logged into the laboratory computer system. A unique laboratory identification number is assigned to each sample at the time of login. This unique laboratory identification allows the sample to be controlled and tracked during storage, handling, and disposal.

5.1.3 Other materials will be properly identified upon verification that they meet specified quality requirements.

5.2 Storage, Handling, and Disposal

5.2.1 Samples and materials received from clients will be stored and handled in a manner that protects integrity, and ensures the quality characteristics are maintained.

5.2.1.1 All samples are stored away from all standards; reagents, food, or any other potentially contaminating sources in such a manner as to prevent cross contamination.

5.2.2 Samples, sample extracts, and any other sample preparation fractions are stored according to the conditions specified by preservation protocols or according to the appropriate test method.

5.2.3 Samples are stored for a minimum of 90 days. If the client provides any relevant instructions regarding sample storage, then the samples are stored according to the client's request.

5.2.4 Samples will be disposed of in a manner that:

- Protects the environment

- Complies with applicable regulatory requirements
- Complies with any project specific requirements

5.1.1 Excess materials will either be returned to the client, or disposed of in accordance with the applicable SOPs.

5.1.2 Access to laboratories and sample storage facilities will be restricted to authorized personnel to further ensure that sample integrity is maintained.

5.1.3 Ambient conditions will be monitored in storage facilities and laboratories where control of those conditions is necessary to maintain the integrity of the sample.

5.3 Notification of Problems

Clients or suppliers will be notified if the integrity of their samples or materials is jeopardized either upon receipt or while in the possession of the company.

5.4 Records

Records of all procedures to which a sample is subjected to while in the laboratory shall be maintained. Chain of custody records shall establish an intact, continuous record of the physical possession, storage, and disposal of all samples.

TABLE 5.0 Sample Containers, Preservatives and Maximum Holding Times

Method	Sample Type	Maximum Holding Times	Container Type	Preservation
EPA Method 8280	Water	30 Days Extraction [1] 45 Days Analysis [2]	Amber Glass Bottle (AGB)	4°C
	Solid	30 Days Extraction [1] 45 Days Analysis [2]	Amber Glass Jar (AGJ)	4°C
EPA Method 8290	Water	30 Days Extraction [1] 45 Days Analysis [2]	AGB	4°C, Dark
	Solid	30 Days Extraction[1] 45 Days Analysis [2]	AGJ	4°C, Dark
	Fish/ Adipose	30 Days Extraction [1] 45 Days Analysis [1]		-20°C, Dark
EPA Method 1668	Water	1 Yr. Extraction [1] 1 Yr. Analysis [2]	AGB	0 - 4°C [3], Dark <-10°C, Dark
	Solid	1 Yr. Extraction[1] 1 Yr. Analysis [2]	AGJ	<-10°C, Dark
	Fish/ Tissue	1 Yr. Extraction [1] 1 Yr. Analysis [1]	AGJ	<-10°C, Dark
EPA Methods 1613A & 1613B	Aqueous	1 Yr. Extraction [1] 40 Days Analysis [2]	AGB	0 - 4°C, Dark [3] [6]
	Drinking Water	7 Days Extraction [1]		<4°C, Dark
	Solid	1 Yr. Extraction [1] 40 Days Analysis [2]	AGB	<-10°C, Dark [8]
	Fish/Tissue	1 Yr. Extraction [1] 40 Days Analysis [2]	AGJ	<4°C <-10°C, Dark [8]
EPA Method 613	Aqueous	7 Days Extraction [1] 40 Days Analysis[2]	AGB	4°C [3], Dark
EPA Method 513	Aqueous	90 Days Extraction [1] 40 Days Analysis [2]	AGB	Ambient, Dark
EPA Method 23	MM5 Train	30 Days Extraction [1] 45 Days Analysis[2] 14 Days from Trap Prep	Train and/or AGB	0 - 4°C, Dark [5]
EPA Method T0-9A [4]	PUF	7 Days Extraction [1] 45 Days Analysis [2] 30 Days PUF Prep		4°C
CARB Method 428 [4]	MM5 Train	30 Days Extraction [1] 45 Days Analysis [2] 30 Days Trap Prep	Train and/or AGB	0 - 4°C, Dark [5]
CARB Methods 429	MM5 Train	21 Days Extraction[1] 40 Days Analysis [2] 21 Days Resin QC Date	Train and/or AGB	4°C, Dark
NCASI 551 [4]	All Samples			4°C

[1] From collection. [2] From extraction (Extrn). [3] If residual chlorine is present sodium thiosulfate is added as per the method. [4] Holding times set by ALTA.
[5] Recommended by ALTA. [6] Adjust sample pH 2-3 with sulfuric acid. [7] From collection until laboratory receipt. [8] Storage at laboratory.

TABLE 5.0 Sample Containers, Preservatives and Maximum Holding Times

Method	Sample Type	Maximum Holding Times	Container Type	Preservation
EPA Method 1614 (Draft)	Water [3]	1 Yr. Extraction [1] 1 Yr. Analysis [2]	AGB	0 - 4°C [3], Dark
	Solid	1 Yr. Extraction[1] 1 Yr. Analysis [2]	AGJ	<6°C, Dark store at <-10°C, Dark
	Fish/ Tissue	1 Yr. Extraction [1] 1 Yr. Analysis [1]	AGJ	<6°C, Dark store at <-10°C, Dark
PCN	Water	1 Yr. Extraction [1] 1 Yr. Analysis [2]	AGB	0 - 4°C [3], Dark <-10°C, Dark
	Solid	1 Yr. Extraction[1] 1 Yr. Analysis [2]	AGJ	<-10°C, Dark
	Fish/ Tissue	1 Yr. Extraction [1] 1 Yr. Analysis [1]	AGJ	<-10°C, Dark
HCB/HCP EPA Method 1625		7 days Extraction [1] 40 days. Analysis [2]	Glass Containers	0 - 4°C [3], Dark

[1] From collection. [2] From extraction (Extrn). [3] If residual chlorine is present sodium thiosulfate is added as per the method. [4] Holding times set by ALTA.
[5] Recommended by ALTA. [6] Adjust sample pH 2-3 with sulfuric acid. [7] From collection until laboratory receipt. [8] Storage at laboratory.

6. Traceability of Materials

Procedures for identifying, controlling, and tracking items purchased from vendors, items developed in-house, samples received from clients, and client reports are detailed in SOPs.

Purchased materials and supplies will be checked to confirm that they meet quality specifications.

6.1 Verification of Items Developed In-house

Items developed in-house such as computer programs, equipment, and procedures, will be tested to verify that they meet the intended objectives. Test records will be maintained so that client reports can be traced to specific items.

6.2 Control of Laboratory Samples

6.2.1 Each sample will be assigned a unique laboratory ID number that will be used to track the sample as it is processed through the laboratory. This unique ID number is also used to associate the analytical results with the sample.

6.2.2 Samples will be batched for analysis. Each batch will be assigned a unique batch number that will be used to associate sample results with quality control data.

6.3 Standards and Reagents Traceability

Documented procedures shall exist for the purchase, reception, and storage of consumable materials used for the technical operations within the laboratory. Certificate of Analysis records for all standards shall be retained by QAU. Reagent and standard preparation documentation shall indicate traceability to purchased stock or neat compounds, reference to method of preparation, date of preparation, expiration date, and preparer's initials.

6.4 Quality Control Records

6.4.1 Records will be maintained to trace calibration standards and instrument calibration data to NIST or USEPA standards as appropriate. If NIST or USEPA standards are not available other standards will be used which are acceptable to specific project requirements.

6.4.2 Each instrument will be assigned a unique ID number. Records will be maintained to document the performance and maintenance of each instrument.

6.4.3 Records will be maintained to identify the individuals responsible for preparing calibration standards, analyzing samples, and reviewing analytical data.

6.4.4 Quality control records will be maintained to demonstrate that individual test procedures have been verified. Individual analytical results will be traceable to these quality control records.

6.5 Certificates of Analysis

All client reports and certificate of Analysis will be uniquely identified. Where appropriate, contract or purchase order numbers will be referenced on client reports. When requested, test procedures will be referenced on Certificates of Analysis.

6.6 Instruments and Equipment

All measuring operations and testing equipment effecting accuracy or validity of tests shall be calibrated and verified before being put into service and on a continuing basis.

7. Process Control

Analytical procedures and other processes which directly affect the quality of services will be conducted under controlled conditions using SOPs which are written at a level of detail appropriate to the complexity of the process.

Personnel will be properly trained before being given responsibility for an analytical procedure or other process that directly affects the quality of a service.

7.1 Instruments and Facilities

7.1.1 Analytical instruments will be maintained in a condition, which will ensure that they are able to meet specified operating conditions.

7.1.2 Laboratory facilities will be designed to meet specific operating conditions, and maintained in a condition, which will ensure that the operating conditions are consistently met.

7.1.3 Results of quality control checks will be recorded.

7.2 Performance Audits

7.2.1 The laboratory shall ensure the quality of results provided to clients by implementing checks to monitor the quality of the laboratories analytical activities.

7.2.1.1 Internal QC procedures.

7.2.1.2 Participation in proficiency testing or other interlaboratory comparisons.

7.2.1.3 Use of certified reference materials.

9. Quality Records

Procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records shall be in accordance with SOPs. Quality records shall include internal audits and management reviews as well as records of corrective actions and preventative actions. Technical records include original observations, calculations and derived data, calibration records and a copy of final report.

9.1 Documentation of Quality Records

9.1.1 Quality records will be generated in accordance with the specification of applicable procedures, programs, and contracts. These records will be maintained to demonstrate that specified quality requirements are met, and that the Quality System is functioning successfully.

9.1.2 Quality records of subcontractor services which affect the quality of the company's services will be required to meet the conditions of this section.

9.1.3 Documents will be clean and legible, and will reference back to the specific activities or procedures to which they apply.

9.2 Quality and Technical Records

9.2.1 Quality and technical records shall be conducted in accordance with SOPs and APs.

9.2.2 History of all samples must be traceable and readily understood through the documentation.

9.2.3 Instruments may not be used in analytical procedures unless maintenance and calibration records indicate that specified quality requirements are achieved. The results of instrument maintenance and calibration inspections will be clearly identified either on the instrument or in maintenance and calibration documents

9.2.4 Work must pass specified quality requirements before it will be released to the succeeding step in the process or, finally, to the clients. The results of quality control checks on work processes will be documented in a manner that clearly indicates the status of the work to the responsible personnel.

9.2.5 Individuals authorized to conduct instrument maintenance and calibration procedures and quality control checks will be identified in the documentation.

9.3 Records Management and Storage

9.3.1 The laboratory shall retain on record all original observations, calculations and derived data, calibration records and a copy of report for a minimum of five years. This applies to both manual and electronic data.

- Individual records will be reviewed and noted if storage requirements longer then five years are required based on client, project or state specific regulations.

9.3.2 Records must provide sufficient information for an adequate audit trail that produces the same results for the sample analytical data. The sample from receipt to analysis must be readily understood through documentation.

9.3.3 All records shall be safely stored, held secure and in confidence to the clients. NELAP related records shall be available to the accrediting authority

9.3.4 All records shall be archived and protected from fire, theft, loss, and environmental deterioration. Any access to archived information shall be documented in the Archive Access Log

9.3.5 Quality documents will be stored in a manner that protects them from loss, damage, unauthorized alterations, and held in confidence to the client.

9.3.6 Documents will be indexed and filed in a manner that allows them to be readily retrieved. Clients will be provided access to records that document the quality of work done for them.

9.3.7 If the laboratory were to transfer ownership, the procedures on handling documents would remain the same. The transfer would ensure that the procedures in place prior to transfer show little significant change for client ease into transition.

9.3.8 If the laboratory were to go out of business, the laboratory would contact the client with the option of how they would like to proceed with their data. All data would be handled according to client or Alta approval for proper destruction or safekeeping.

8. Laboratory Instrumentation

All laboratory instrumentation and testing equipment used by the company will be maintained and calibrated in accordance with SOPs to verify proper operation. Figure 8.1 details a list of current laboratory instrumentation for analysis.

Instrumentation will be placed into service dependent upon the capability of achieving the accuracy required and shall comply with relevant specifications to the instrument.

Laboratory instrumentation and testing equipment shall be operated by authorized personnel.

Instrumentation and equipment will be used in a manner that ensures that measurement uncertainty is known and consistent with specified quality requirements.

Methods and intervals of calibration specified for each instrument will be based on the individual operating characteristics of the instrument and the quality requirements of the analytical procedure.

8.1 Calibration Standards and Instruments

8.1.1 Calibration and verification procedures will use standards and instruments, whenever applicable, that are traceable to recognized national or international standards. Where traceability to national standards does not exist, the basis for the calibration will be documented.

8.1.2 Prior to use, laboratory instrumentation and testing equipment shall be calibrated and checked to establish that it meets the laboratory's specification requirements and complies with the relevant standard specifications.

8.1.3 Where applicable, reference standards and instrumentation will be checked periodically between calibration and verification procedures.

8.2 Calibration Records

8.2.1 Except for procedures requiring reanalysis, calibration prior to each analysis and previous calibration data will be reviewed when an instrument is out of calibration to determine whether or not the analytical results are acceptable.

8.2.2 Instruments that are unable to maintain calibration or not operating properly will be taken out of service. Instruments will not be placed back into service until they have been repaired and verified to be operating properly.

8.2.3 The records for each test or calibration shall contain sufficient information to indicate whether specified quality or process parameters are achieved. Each instrument will be assigned a unique ID number. Records will be maintained to document the performance and maintenance of each instrument.

Figure 8.1 Instrument List

Name	Acquired	Department
Waters Autospec Ultima High Resolution Mass Spectrometer VG-6	2000	HRMS
Waters Autospec Ultima High Resolution Mass Spectrometer VG-5	1998	HRMS
Waters Autospec Ultima High Resolution Mass Spectrometer VG-7	2001	HRMS
Waters Autospec Ultima High Resolution Mass Spectrometer VG-8	2001	HRMS
Waters Autospec Ultima High Resolution Mass Spectrometer VG-9	2004	HRMS

10. Corrective Action

Nonconforming conditions are when any aspect of the quality system or technical operations does not conform to procedures or to client requirements. Nonconforming conditions have an adverse effect to the quality specifications and are handled in accordance with SOPs. If a nonconformance occurs, where necessary, the client shall be notified.

The applicable SOPs provide instructions for determining the root cause of nonconforming conditions, designing and implementing corrective action, and evaluating the effectiveness of the corrective action.

10.1 Causes of Nonconformance

Procedures will be implemented to determine the root cause of nonconformance conditions, and the corrective action will be designed to eliminate the root cause and prevent reoccurrence.

10.2 Corrective Action

10.2.1 Corrective actions are taken immediately, together with any decision about the acceptability of the nonconforming work. Procedures that result in or allow nonconformance conditions will be revised. If necessary, new procedures will be written.

10.2.2 The revised or new procedures will be implemented and evaluated to ensure that the corrective action steps taken effectively eliminate the nonconformance conditions.

10.3 Documentation

10.3.1 Results of root cause analyses and corrective action steps implemented to eliminate nonconformance conditions will be documented and reported to appropriate levels of management in accordance with laboratory SOPs. Records of corrective actions shall be maintained by QAU.

11. Reports

Handling, storage, packaging, and, when applicable, delivery of client reports will be conducted in accordance with SOPs to ensure that specified quality requirements and confidentiality of the reports are maintained. The reports shall include all the information requested by the client or required by the method used. Reports may also include electronic data. Electronic data will follow the same criteria as reports. Any information not reported to the client shall be readily available in the laboratory.

11.1 Handling and Storage of Reports

11.1.1 Reports and files will be handled in a manner that ensures that client confidentiality is maintained, and that the reports are protected from loss, damage, or unauthorized alterations.

11.1.2 All reports and files will be coded for ease of identification and retrieval.

11.1.3 File cabinets and storage rooms will be designed to protect filed copies of reports from loss, damage, or unauthorized alterations.

11.1.4 Computer files will be backed up to electronic storage media and stored in a manner that protects them from loss, damage, or unauthorized personnel.

11.1.5 The condition of reports and files in storage will be periodically evaluated to ensure that there is no deterioration, and that the reports remain readily accessible to authorized personnel.

11.1.6 NELAP related records shall be made available to the accrediting authority, and shall be maintained for a minimum of five years.

- Individual records will be reviewed and noted if storage requirements longer then five years are required based on client, project or state specific regulations

11.2 Packaging and Delivery of Reports

11.2.1 Client reports will be inspected prior to delivery to ensure that they meet specified quality requirements. Then the reports will be packaged for delivery to the client in a manner that ensures protection while in transit.

11.2.2 When required by specific contractual stipulations, the company will assume responsibility for protection of client reports while en route to the client.

11.3 Laboratory Report Format and Content
All laboratory reports shall include, at least, the following information:

11.3.1 A title, indicating the nature of the document (i.e. Test Report, Laboratory Results);

11.3.2 Name and address of the laboratory, location analysis was conducted if different from the address of the laboratory, and a phone number with name of a contact person;

11.3.3 Unique identification of the report and of each page, and the total number of pages. It must be clear that discrete pages are associated with a specific report, and that the report contains a specified number of pages;

11.3.4 NELAC accredited logo and a statement certifying that the report meets all requirements of NELAC and cannot be reproduced;

11.3.5 Name and address of client, where appropriate and project name if applicable;

11.3.6 Description and unambiguous identification of the tested sample including the client identification code;

11.3.7 Identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature;

11.3.8 Date of receipt of sample, date and time of sample collection, date(s) of performance test, and time of sample preparation and/or analysis if the required holding time for either activity is less than or equal to 72 hours;

11.3.9 Identification of the test method used, or unambiguous description of any non-standard method used;

11.3.10 If the laboratory collected the sample, reference to sampling procedure;

11.3.11 Any deviations from, additions to or exclusions from the test method, and any non-standard conditions that may have affected the quality of results, and including the use and definitions of data qualifiers (Table 11);

11.3.12 Measurements, examinations and derived results, supported by tables, graphs, sketches and photographs as appropriate, and any failures identified; identify whether data are calculated on a dry weight or wet weight basis, identify the reporting units;

11.3.13 A signature and title, or an equivalent electronic identification of the person(s) accepting responsibility for the content of the report, and date of issue;

11.3.14 Clear identification of all test data provided by outside sources, such as subcontracted laboratories, clients, etc.

- The original report from subcontracted laboratories should be included in the client laboratory report.

11.3.14 After issuance of the report, the report remains unchanged.

11.3.14.1 Any report that requires amending must clearly state that the report has been revised. The amended report must also meet the requirements set forth within Chapter 5 of the NELAC standards.

Table 11.0 DATA QUALIFIERS & ABBREVIATIONS

B	This compound was also detected in the method blank.
D	The amount reported is the maximum possible concentration due to possible chlorinated diphenylether interference.
H	The signal-to-noise ratio is greater than 10:1.
I	Chemical Interference
J	The amount detected is below the Lower Calibration Limit of the instrument.
*	See Cover Letter
Conc.	Concentration
DL	Sample-specific estimated detection limit
MDL	The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero in the matrix tested.
EMPC	Estimated Maximum Possible Concentration
NA	Not applicable
RL	Reporting Limit – concentrations that corresponds to low calibration point
ND	Not Detected
TEQ	Toxic Equivalency

Unless otherwise noted, solid sample results are reported in dry weight. Tissue samples are reported in wet weight.

The control limits are "interim limits only" until in-house limits are utilized.

12. Performance and System Audits

Performance, System, and External audits are conducted to verify conformance with ALTA's quality assurance program, to determine the effectiveness of the QA program, and to continually improve ALTA's data quality.

12.1 System Audits

12.1.1 Internal audits (facility audits) of activities affecting the quality of the company's services will be conducted by the QAU on a regular schedule in accordance with laboratory SOPs. Internal audits are performed biannually. The QAU is trained and qualified as an auditor who, wherever possible, is independent of the activities being audited. Internal audits verify that operations continue to comply with the requirements of the quality system and NELAC standards.

12.1.2 It is the responsibility of the QAU to plan and organize audits based on a predetermined schedule or as requested by management.

12.1.3 SOPs and checklists will be used to focus the internal audit on specific activities of the area to be audited.

12.1.4 Personnel will not be allowed to audit activities for which they are responsible or in which they are directly involved, unless it is demonstrated that an effective, nonbiased, audit can be performed.

12.2 Reporting of System Audits

12.2.1 Results of internal audits will be documented by the audit team and submitted to the manager(s) in charge of the audited area and the management of the QAU.

12.2.2 Appropriate corrective action steps will be promptly taken to address any deficiencies or areas for improvement identified by the internal audit. Laboratory management shall ensure that these actions are within the agreed time frame.

12.2.3 Laboratory management shall immediately notify, in writing, any client whose work may have been affected by any found deficiencies.

12.2.4 All records of internal facility inspections and responses will be maintained by the QAU.

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12.3 Management Reviews

12.3.1 Management shall review the quality system annually to evaluate its continuing suitability and effectiveness and make any necessary changes or improvements.

12.3.2 The review may include account reports from managerial and supervisory personnel, the outcome of recent internal audits, assessments by external bodies, the results of interlaboratory comparisons or proficiency tests, any changes in the volume and type of work undertaken, feedback from clients, corrective actions and other relevant factors.

12.4 Performance Audits

12.4.1 Performance audits are conducted as single blind assay samples. A performance evaluation sample (PE), purchased from an independent contractor, is analyzed twice a year. The acceptable result for the PE sample is unknown until after the experimental result is reported to the contractor. Other externally originated PEs are analyzed when supplied by the client as either a single blind or as a double blind sample and are scheduled through the laboratory as routine samples. All performance audits are handled in the same manner as real environmental samples including staff, method, procedures, equipment, facilities, and frequency.

12.5 External Audits

12.5.1 External audits are performed on an on-going basis by clients, regulating agencies (State and Federal), or other third party auditors. These audits are pre-scheduled with the client and QAU to ensure that the appropriate laboratory personnel are available to address all audit inquiries. All deviations or deficiencies noted during the audit are to be addressed in the time frame provided by the auditor.

12.6 Data Audits

12.6.1 Data audits at ALTA utilize a three tier data review system involving laboratory directors, client managers and the QAU.

12.6.2 Tier 1. In the initial phase, the analyst, defined as the instrument operator, completes final data calculations, enters the data and submits the results to a laboratory director for review. In the case of anomalies, the laboratory director may require the analyst to prepare a corrective action report (CAR) discussing the potential causes for the problems encountered as well as the recommended corrective action. The analyst reviews the data, signs and dates the raw data and any CAR's (if applicable). The laboratory director after review of the data will approve all final datasheets.

12.6.3 Tier 2. The second tier review requires the project manager, defined as the laboratory director signing the cover letter of the final report, to review and approve the data package. The project manager examines the data for completeness and assesses whether the package as a whole meets the data quality objectives set by the client. The project manager is required to discuss or explain any data anomalies in the text of the cover letter.

12.6.4 Tier 3. The third tier review is performed by the quality assurance unit (QAU). The QAU will audit approximately 5% of the data packages and review all aspects of the data package covered during the second and third tier reviews. The QAU review may result in a request to the laboratory director for additional information regarding the data set and if necessary, re-analysis of selected samples.

12.6.5 For convenience, the checklists shown in Tables 12.0 and 12.0A are used to determine completeness and accuracy of projects.

Table 12. 0 HRMS REVIEW CHECKLIST

		PM#1	PM#2	QA	COMMENTS
QC	MB included with batch?				
	OPR/LCS results within limits?				
Prep	Samples checked in and out?				
	Cycle times documented?				
	% solids entered correctly?				
	Sample amts. on extn sheet match sample wts. on final benchsheet?				
Analysis	Do sample amounts on the raw data match the final benchsheet?				
	Are all standards, QC, and samples in the run log accounted for in data package?				
	RTs within windows?				
	Diphenyl ethers qualified?				
	Lower amt. For 2378 TCDF (DB5,DB225) reported?				
	Positives in MB <lower calibration limit?				
	Sample wt. on raw data same as sample wt. on benchsheet?				
	Calculate conc. of few analytes				
	Total DLs are $\geq$ 2378s.				
	Calculate RL for PCBs and PAHs				
Reports	*Project COC and Paperwork:*				
	COC is signed and dated?				
	Review COC and paperwork for special reporting instructions				
	EDDs requested?				
	Case Narrative:				
	Is the client name and address correct?				
	Is the correct sample number and matrix included?				
	Login anomalies are noted in report?				
	Is the date received correct?				
	Is the correct method documented?				
	Asterisks on datasheets documented?				
	Sample Inventory Report:				
	Is the date received correct?				
	Does the Client Sample ID match the client COC?				

Table 12.0 HRMS REVIEW CHECKLIST (Cont.)

		PM#1	PM#2	QA	COMMENTS
Reports	***Datasheets:***				
	Results reflect raw data accurately?				
	Correct matrix reported?				
	Correct units reported?				
	Positives in Method Blank are qualified with a "B" on sample datasheets.				
	Positives under the lower calibration limit are qualified with an "A"				
	Positives above the upper calibration limit (extract concentration) are qualified with an "E".				
	EMPC results are not qualified				
	Dates correct? (Date received, analyzed, prepped,confirmed)				
	2378 TCDF confirmed if > MLCL				
	Any labeled compounds outside QC limits qualified?				
	Verify that correct TEQ is reported.				
	%Solids reported for solid samples?				
	Appendix:				
	Sample Login Checklist present?				
	Anomaly form included, if necessary?				
	Client COC included?				
	Sample Login Checklist complete?				
	Sample Login Checklist correct?				

PM #1 Initial/Date: _____
PM #2 Initial/Date: _____
QA Initial/Date: _____

Table 12.0A-HRMS STANDARDS REVIEW CHECKLIST

Beginning Calibration ID: _____ Ending Calibration ID: _____

	Beg.CAL	End. CAL	COMMENTS
Calibration Verification/Form 4A/B: Ion abundance within QC limits?			
Calibration Verification/Form 4A/B: Conc within Conc. range?			
Form 5: First and last eluters present? (N/A for DB225)			
Form 6A/6B: Relative Retention Times within limits? (N/A for M23, TO9, 1668, DB225)			
Cal. Ver. Named correctly? (Ex. ST-Year-Month-Day-VG ID)			
Cal. Verification forms signed and dated for review?			
Appropriate ICAL referenced?			
Run log: Standards named correctly? Correct Instrument listed?			
Run log: Samples within 12-hour shift?			
Mass resolution > 10,000			
2378-TCDD/TCDF valley < 25% (N/A for 1668)			
All appropriate peaks integrated correctly?			
Manual integrations included?			
8280: Ratios within limits?			
8280: S/N > 2.5:1			
8280: CS1 within 12 hrs?			

Reviewer Initial/Date:_____QA* (Random 5% Check) Initial/Date:_____

13. Training

Training assessments and all related training documentation shall be conducted in accordance with SOPs.

13.1 Initial On-Site Training

13.1.1 The training requirement of each employee will be assessed periodically to ensure the competency of their job responsibilities, that career development objectives are being met, and that general-purpose educational opportunities are being utilized. The training program shall be relevant to the present and anticipated tasks of the laboratory.

13.1.2 Previous training, education, and experience will be considered when evaluating the training needs of each employee.

13.1.3 Manuals, texts, SOPs, journals, analytical methods and inhouse Analytical Procedures are available for all new trainees, with on the job training performed by senior staff.

13.2 Training Programs

13.2.1 Job related training will be provided through regularly scheduled in-house seminars and courses, university courses, conferences and seminars, and one-on-one on the job tutorials.

13.2.2 Specified performance criteria must be successfully met while under supervision before personnel will be made responsible for activities that affect the quality objectives of the company.

13.3 Training Documentation

Training records will be maintained in each individual's training file. These records will be readily available to supervisors to ensure that employees have demonstrated capability prior to performing activities for which they are responsible. Employees are responsible for keeping their training file up-to-date. The training files shall maintain records of competence, education and professional qualifications, training, skills and experience of all technical personnel, including contracted personnel.

13.3.1 Evidence on file demonstrating each employee has read and understood the current version of in-house quality documents (QM, QAPP, SOPs, APs).

13.3.2 Documentation of training courses.

13.3.3 Documentation of continued proficiency at least once per year.

14. Client Services

Routine client service as well as responses to client inquires, audit reports, recommendations, and complaints will be handled in accordance with SOPs.

14.1 Routine Services

14.1.1 Each client will be assigned a Project Manager who will be responsible for ensuring that the needs of the client are clearly understood and communicated to the appropriate areas of the company.

14.1.2 The Project Manager reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work. Once the Project Manager accepts the new work, an acknowledgement letter is sent to the client for confirmation.

14.1.3 Clients will be given the opportunity to verify that the company's services conform to specified requirements. Regardless of whether or not client verifications are conducted, the Quality System will be responsible for ensuring that all services conform to specified requirements.

14.1.4 As the client's representative, the Project Manager will be responsible for ensuring that the client's needs are met. The Project Manager will maintain good communication, advice and guidance in technical matters, and opinions and interpretations based on results.

14.1.5 All client data are managed and maintained with the utmost care and diligence to ensure that the protection of clients' confidential information and proprietary rights are a primary concern.

14.2 Contract Review

For all analytical service to be provided contract review is accomplished through the generation of a written quote or contract. Sales and client services personnel are responsible for implementing and documenting contract review. Client requirements are defined and documented in the written quote or contract.

14.3 Responses to Client Audits, Inquiries, and Complaints

14.3.1 The QAU will be responsible for coordinating responses to client audits.

14.3.2 Complaints received from clients or other parties regarding data or laboratory activities will be directed to the appropriate project manager and reported to the laboratory president or vice presidents.

14.3.3 If a corrective action(s), which may require completion of a CAR (corrective action report), is taken, this will be documented and archived with the appropriate project data.

14.3.4 All complaints will be documented and records of actions in response to any complaints will be maintained.

14.3.5 If a complaint raises doubt regarding the laboratory's policies or compliance with NELAP or other standards, those areas shall be promptly reviewed or audited by the laboratory QAU.

15. Statistical Techniques

Statistical techniques used to monitor the performance of activities that directly affect quality objectives will be conducted in accordance with SOPs.

15.1 Statistical Process Control Procedures

15.1.1 Statistical Process Control will be used to monitor analytical procedure performance indicators such as accuracy and precision, and process performance indicators such as turnaround time and Nonconformance reports.

15.1.2 Results of SPC analyses will be used to improve processes that affect quality objectives.

16 Subcontracting

Alta Analytical may subcontract services, or may refer a client directly to another lab, for a particular analysis. Subcontracted laboratories are held responsible for the implementation of their own QM and meeting their data quality objectives.

16.1 Clients shall be notified prior to subcontracting any portion of their testing to another laboratory.

16.2 Services requiring NELAC accreditation will only be subcontracted to a laboratory with NELAC accreditation.

16.3 For services associated with projects outside of California, individual state accreditations may need to be met.

16.4 Alta Analytical shall retain records demonstrating that the above requirements have been met. Original reports received from a subcontracted laboratory will be included with the clients test report.

17. Ethics Policy

Alta Analytical expects employee compliance with all laboratory SOPs and applicable regulatory guidelines and standards. Alta encourages participation in cooperative and educational efforts designed to promote and inform laboratory personnel of the necessity of active compliance.

17.1. Alta does not condone nor will tolerate the fraudulent manipulation or falsification of data, intentional non-compliance or gross negligence. All such acts are to be reported directly to management or the QAU immediately for appropriate corrective action.

17.2. Upon hire, new employees are required to read and sign a confidentiality statement. This signed statement is maintained in their personnel files.

17.3. Ongoing education and training in ethical and legal responsibility, including potential penalties associated with actions, is performed at Alta Analytical. An ethics statement and documentation of training attendance is maintained in individual training records.

APPENDIX

Resumes of Key Personnel

State of Arizona Certification
(Expiration Date Subject to Change)

William J. Luksemburg

President

EDUCATION

B.S. Chemistry, California State University, Fresno, CA (1974)

EXPERIENCE

Present **President, ALTA Analytical Laboratory**
Responsible for the management of business planning including venture funding, sales and marketing and the review of laboratory operations.

1990 - 2000 **Director of HRMS Services, ALTA Analytical Laboratory**
Mr. Luksemburg, a co-founder, directed the routine analysis and method development work in the High Resolution Mass Spectrometry department. He was responsible for marketing HRMS dioxin services to environmental engineering firms, the pulp and paper industry, government agencies and other industrial clients. Mr. Luksemburg was also responsible for the development of new markets using HRMS instrumentation. In addition Mr. Luksemburg directed routine and special projects, reviewed and interpreted data, and interfaced with clients.

1986 - 1990 **Principal Scientist/HRMS Manager, Enseco-Cal Lab**
As Principal Scientist in the Special Services department at Enseco-Cal Lab Mr. Luksemburg coordinated the operation and maintenance of five high resolution magnetic sector instruments. He was responsible for developing a business that now is one of the major suppliers of HRMS PCDD/PCDF analysis to the pulp and paper industry in the U.S. Mr. Luksemburg also coordinated the training and development of the staff in the operation and maintenance of HRMS instruments.

1979 - 1986 **Senior Chemist, Radian Corporation**
In Radian's Sacramento laboratory, Mr. Luksemburg was GC/MS supervisor for ABN and VOA analysis. He coordinated the activities of five chemists in the operation and maintenance of four quadrupole mass spectrometers.

1974 - 1979 **Chemist, Carnation Company**
As a staff chemist, Mr. Luksemburg was involved in the analysis of products and ingredients used in Carnation's animal feed division.

QUALIFICATIONS

Mr. Luksemburg has over 20 years experience in production analytical laboratories including 15 years experience in the field of environmental mass spectrometry. Much of this experience has involved PCDD/PCDF analysis of environmental samples and for the last seven years has concentrated on High Resolution Mass Spectrometry analysis of PCDDs/PCDFs in a variety of matrices. Mr. Luksemburg is recognized throughout the pulp and paper industry for his research and production work on dioxins and furans. He recently was recognized on the international level when his chapter on dioxin analysis of pulp and paper (Rappe, 1991), was published by the World Health Organization. He is one of the few individuals in the world to successfully adapt the high-resolution magnetic sector instruments to "production" analysis of environmental samples at the picogram and femtogram levels.

RECENT PRESENTATIONS

"Determination of Method Detection Limits in Pulp and Paper Mill Effluents," in Rotorua, New Zealand, at the *ISWPC Post Symposium Workshop*, May 1991.

"Comparison of NCASI Method 551, EPA Method 1613A, and the Proposed FDA Method for the Analysis of 2,3,7,8-TCDD and 2,3,7,8-TCDF in Food Packaging Material," in Boston, MA, at the *1993 TAPPI Environmental Conference*, March 1993.

“Extraction of Large Volumes of Aqueous Samples Using Solid Phase Extraction Disks,” in Portland, OR at the *1994 TAPPI Environmental Conference*, April 1994.

“PCDDs and PCDFs in Urban Stormwater Discharged to San Francisco Bay, California,” in Amsterdam at the *1996 Dioxin 16th Symposium on Chlorinated Dioxins and Related Compounds*, August 1996.

PUBLICATIONS

NCASI Technical Bulletin No. 551, "NCASI Procedures for the Preparation and Isomer Specific Analysis of Pulp and Paper Industry Samples for 2,3,7,8,-TCDD and 2,3,7,8-TCDF," LaFleur, L., Ramage, K., Bousquet, T., Brunck, R., Luksemburg, W., Miille, M., Peterson, R., and Valmores, S., (1989).

"Optimization of Extraction Procedures for the Analysis of TCDD/TCDF in Pulp, Paper Base Stocks, and Pulp Industry Solid Wastes," Lafleur, L., Ramage, K., Gillespie, W., Luksemburg, L., Miille, M., and Valmores, S., Chemosphere, Vol. 19, pp 643-648, 1989.

"Analytical Procedures for the Analysis of TCDD and TCDF in Food Sources," LaFleur, L., Bousquet, T., Ramage, K., Davis, T., Luksemburg, W., and Peterson, R., Presented by L. Lafleur at Dioxin '89, Toronto, Canada. Waiting publication in Chemosphere.

"Determination of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans in Pulp and Paper Industry Wastewaters, Solid Wastes, Ashes and Bleached Pulps," Luksemburg,

PUBLICATIONS (Continued)

W., Environmental Carcinogens-Methods of Analysis and Exposure Measurement-Volume 11, World Health Organization, Christopher Rappe, Editor, 1991.

"Potential Sources of Polychlorinated Dibenzothiophenes in the Passaic River, New Jersey,"
Huntley, S., Wenning, R., Paustenbach, D., Wong, A., and Luksemburg, W., Chemosphere,
Vol. 29, No.2, pp 257-273, 1994.

"Polychlorinated Dioxins and Dibenzofurans in Environmental Samples From China," Luksemburg, W., Mitzel, R., Huaidong, Z., Hedin, J., Silverbush, B. and Wong, A., Dioxin `96, Vol. 28, pp 262-263, 1996.

"Transport of Chlorinated Dioxin and Furan Contaminants in Pentachlorophenol-treated Wood to Milk and Adipose Tissue of Dairy Cattle," Fries, G., Wenning, R., Paustenbach, D., Mathur, D., and Luksemburg, W., Dioxin '96, Vol. 29, pp 447-449, 1996.

"Polychlorinated Dioxins and Dibenzofurans in Environmental Samples from China," Luksemburg, W., Mitzel, R. S., Hedin, J. M., Silverbush, B. B., Wong, A. S., Zhou, H. D., Dioxin `96, Vol. 28, pp. 262, 1996.

"Polychlorinated Dioxins and Dibenzofurans (PCDDs/PCDFs) in Environmental and Human Hair Samples Around a Pentachlorophenol Plant in China," Luksemburg, W., Mitzel, R.S., Hedin, J. M., Silverbush, B. B., Wong, A. S. and Zhou, H. D., Dioxin `97, Vol. 32, p. 38, 1997.

PROFESSIONAL AFFILIATIONS

American Society for Mass Spectrometry
American Chemical Society
Technical Association of the Pulp and Paper Industry

James M. Hedin

Principal Scientist

EDUCATION

B.S. Chemistry, University of Minnesota, Duluth, MN (1986)

EXPERIENCE

Present **Principal Scientist, ALTA Analytical Laboratory**
Mr. Hedin performs routine analysis and method development work in the High Resolution Mass Spectrometry department. He is responsible for routine maintenance of HR/MS instruments. Mr. Hedin also aids in the training of new staff, reviews and interprets data, and interfaces with clients.

1990-1999 **Associate Scientist, ALTA Analytical Laboratory**
Mr. Hedin performs routine analysis and method development work in the High Resolution Mass Spectrometry department. He is responsible for routine maintenance of HR/MS instruments. Mr. Hedin also aids in the training of new staff, reviews and interprets data, and interfaces with clients.

1988 - 1990 **GC/MS Chemist, Enseco-Cal Lab**
As GC/MS Chemist at Enseco-Cal Lab Mr. Hedin was responsible for the operation and maintenance of quadrapole GC/MS instruments. His duties entailed sample analysis by EPA methods for volatiles and semi-volatiles. Mr. Hedin also aided in the training of the staff in the department.

1987 - 1988 **Extraction Chemist, Enseco-Cal Lab**
Mr. Hedin's duties entailed sample extraction for Dioxin/Furan Analysis by High Resolution Mass Spectrometry. He assisted in the training of new staff, and the development of new extraction techniques.

QUALIFICATIONS

Mr. Hedin has over 13 years experience in production analytical laboratories including 11 years experience in the field of environmental mass spectrometry. Much of this experience has involved PCDD/PCDF analysis of environmental samples and for the last three years has concentrated on High Resolution Mass Spectrometry analysis of PCDD's/PCDF's in a variety of matrices.

PROFESSIONAL AFFILIATIONS

American Society for Mass Spectrometry

Martha M. Maier

Director of HRMS Services

EDUCATION

B.S.	Chemistry, University of Wisconsin, Madison, WI (1983)
B.S.	Philosophy, University of Wisconsin, Madison, WI (1983)

EXPERIENCE

Present — **Director of HRMS Services, Alta Analytical Laboratory, Inc.**
As Director of HRMS Services oversees the routine operations of the High Resolution Mass Spectrometry Group. Performs the interpretation and final review of analytical data, and issues final reports. Acts as a liaison between the laboratory and the Quality Assurance department. Project manager for routine and special projects.

1999-2001 — **Director, Ultra-Trace Analyses Group, Paradigm Analytical Laboratories, Inc**
Responsible for extractions, analyses, final review and processing of all data generated by the group. Served as project manager. Oversaw the development of analytical procedures for the analysis for PCBs by HRMS (Method 1668A), as well as the implementation of NELAP certification.

1998-1999 — **Bioanalytical Project Manager, Alta Analytical Laboratory**
Liaison between pharmaceutical clients and the Liquid Chromatography Mass Spectrometry (LCMS) Services group, ensuring efficient study management and timely reporting of laboratory results. Directed all phases of study conduct, including: review of study protocols and sponsor Standard Operating Procedures; initiation, maintenance and review of study and raw data files; scheduling of sample analyses; and preparation of final reports.

1992-1998 — **Associate Scientist, Alta Analytical Laboratory**
Involved in sales and project management. Directed sample analysis, reviewed data and prepared reports. Presented papers and gave educational seminars and presentations on dioxin/furan analysis. Arranged exhibit schedule and represented the laboratory at technical meetings and industry conferences. From 1992-1997, acted as laboratory representative for the Eastern U.S., both in sales and project management capacities.

1990-1992 **Technical Sales, Enseco-Cal Lab**
Coordinated the dioxin/furan marketing program. Prepared bids, organized exhibits, and oversaw the production of marketing materials. Acted as a liaison between the salespeople and the dioxin/furan laboratory.

1988-1990 **HR GC/MS Operator, Enseco-Cal Lab**
Dioxin/furan analysis of pulp, food, and low-level environmental samples using high resolution GC/MS. Promoted to scientist position in December 1989. Involved in data review and project management.

1987-1988 **GC/MS Operator, Enseco-Cal Lab**
Dioxin/furan analysis using low-resolution GC/MS systems. Promoted to lead person in May 1988.

1986-1987 **GC/MS BNA Operations Supervisor, Radian Corporation**
Responsible for the scheduling and completion of all semi volatile analyses. Trained other operators in BNA analysis and routine instrument maintenance.

1984-1986 **GC/MS Operator, Radian Corporation**
Analyzed environmental samples for volatile and semi volatile organic pollutants using EPA Methods 624, 625, SW-8240, SW-8270, and by EPA Contract Lab Protocol. Performed routine maintenance on all systems. Responsible for interfacing the GC/MS lab with the laboratory database management system.

1984-1984 **Analytical Chemist, Wisconsin Department of Agriculture**
Assayed pesticide formulations using HPLC, GC, and TLC. Researched, developed and modified methods.

QUALIFICATIONS

Ms. Maier has over 17 years of experience in the environmental laboratory, including 11 years of specialization in dioxin/furan analysis.

AFFILIATIONS

Air & Waste Management Association
American Chemical Society
Technical Association of the Pulp & Paper Industry

Kathleen P. Dewhirst

Quality Assurance Associate

EDUCATION

B.S. Chemistry, California State University, Hayward, CA (1992)

EXPERIENCE

Present **Quality Assurance Associate, Alta Analytical Laboratory**
Ensure compliance to National Environmental Laboratory Accreditation Program (NELAP) and Alta's Quality Manual (QM) and Standard Operating Procedures (SOP) as well as other regulatory agencies; review and manage MDLs, IPRs, PE samples; review data packages for compliance and completeness; maintain state certifications; maintain and update SOPs and APs, maintain archives; maintain and update control charts; initiate and maintain employee initiation and training; maintain and update QM and SOQ.

2004 – 2005 **Quality Control Technician, Immuno Concepts**
Quality control inspections, testing and releasing of raw materials and testing systems for antibodies to nuclear antigens and autoimmune diseases under GMP/GLP principals. Extensive trouble-shooting and project investigations of abnormal quality results including handling and treatment of blood sera used in test systems. Extensive data review for quality assurance and quality control principals and document control. Tests performed include the following: Elisa, AutoID, EA/EBNA Viral, Crithidia DNA, and HEP2/HEP2000 FA/CZ antibody systems.

1998 – 2003 **Water Quality Technician. Ops. Dept., Alameda County Water District**
Operation, maintenance and trouble-shooting of the Lachat FIA for analyzing potable and non-potable water including; Well water, Storm Water, Treatment plant and Watershed samples. Bacterial testing on water samples and data entry into LIMS database. Proficiency testing, extensive data review including Quality Control Charts and control of documents, and knowledge of GLP and QA/QC principals. Extensive knowledge of "Standard Methods for the Treatment of Water and Waste Water". Various tests performed for Conductivity, Turbidity, Residual Chloride and pH. Heavy customer complaint response and sample receiving.

1995 – 1998 **Chemist, Evergreen Oil Inc.**
Operation, maintenance and trouble-shooting of all instruments used for analyzing waste oil, recycled oil, and waste water quality testing. Various tests performed

for EPA 601/602, EPA 8010, EPA 624, PCBs by GC, USD metals by ICP, TTOs, Halogens, metals by graphite furnace and other wet chemistry tests. Extensive GLP and QA/QC knowledge for document control and review.

1992 – 1993 **Research Assistant, Quality Control, Penederm Inc.**
Qualified Raw materials and finished products under USP protocols with extensive knowledge of GLP and QC principals. Control of materials received and requested. Control of documents and method writing. Operation of water purification system under EPA/USP protocol for sterile and drinking water. Instruments include: Waters 2010 HPLC, Beckman UV/VIS, Orion Karl Fisher, Brookfield Viscometers, and HP IR. Many wet chemistry tests such as oxidation/reduction and acid/base titrations.

189 – 1992 **Research Assistant, I – Chem Research**
Operator of the EXTREL GC/MS for the analysis of bases and acids under EPA Protocol. Operation, maintenances and troubleshooting; data acquisition and analysis. Analysis for VOAs with Varian Purge and Trap. Analyzed for PCBs under EPA protocol with HP GC. Knowledge of QA/QC and GLP principals for document writing and review.

Qualifications

Mrs. Dewhirst has over 14 years in analytical chemistry. Her background in GC/MS analysis and quality assurance and control gives her a solid working knowledge of instrument operation, sample analysis and data review for this position. Thorough documentation, effective communication and a strong dedication to GMP and GLP have strongly benefited her for customer and client interactions.

Professional Affiliations and Training and Certification

American Chemical Society

40 hour Hazardous Waste Operation Training Certification
DW1 Treatment Operator Training Certification

Arizona Department of Health Services

Division of Public Health Services
Office of the Assistant Director
Public Health Preparedness Services

250 N. 17th Avenue
Phoenix, Arizona 85007
(602) 364-0720
(602) 364-0759 FAX

JANET NAPOLITANO, GOVERNOR
CATHERINE R. EDEN, DIRECTOR

February 15, 2005

Ms. Martha Maier
Alta Analytical Laboratory, Inc.
1104 Windfield Way
El Dorado Hills, CA 95762

Dear Ms. Maier:

This is to confirm that your laboratory has fulfilled all requirements for Arizona Environmental Laboratory Licensure under the Arizona Revised Statute §§ 36.495 et.sec. and rules.

Your Arizona Environmental Laboratory License number is AZ0639, which is the number you will need to use when reporting compliance results to ADEQ or the USEPA.

If there are any questions, please do not hesitate to call me at the letterhead telephone number.

Sincerely,

Barbara A. Escobar

Barbara A. Escobar
Program Manager
Office of Laboratory Licensure,
Certification & Training
Bureau of State Laboratory Services

BAE:mv

Arizona Department of Health Services

ENVIRONMENTAL LABORATORY LICENSE

Issued to:

Laboratory Director: **Martha Maier**
Owner/Representative: **William J. Luksemburg**

Alta Analytical Laboratory, Inc.
AZ0639

is in compliance with Environmental Laboratory's applicable standards for the State of Arizona and maintains on file a List of Parameters for which the laboratory is certified to perform analysis.

PERIOD OF LICENSURE FROM: 02/18/2005 TO: 02/17/2006

GREAT SEAL OF THE STATE OF ARIZONA
DITAT DEUS
1912

Steven D. Baker, Chief
Office of Laboratory Licensure,
Certification & Training
Bureau of State Laboratory Services

Arizona Department of Health Services
Office of Laboratory Licensure, Certification & Training
250 North 17th Avenue, Phoenix, AZ 85007

Wednesday, October 20 2004

AZ License: AZ0639

Lab Director: Ms. Martha Maier

Lab Name: Alta Analytical Laboratory, Inc.
Phone: 916-933-1640
Fax: 916-673-0106

Program HW

Parameter	EPA Method	Billing Code	Cert Date
Polychlorinated Dibenzo-P-Dioxins	EPA 8280A	SOC17	02/18/03
Polychlorinated Dibenzo-P-Dioxins	EPA 8290	SOC17	12/12/03

Total Licensed Parameters in this Program: 2

Program SDW

Parameter	EPA Method	Billing Code	Cert Date
Dioxins And Furans	EPA 1613	SOC17	02/18/03

Total Licensed Parameters in this Program: 1

Program WW

Parameter	EPA Method	Billing Code	Cert Date
Dioxins And Furans	EPA 1613	SOC17	10/20/04

Total Licensed Parameters in this Program: 1

Instruments	Quantity	Date
GAS CHROMATOGRAPH/MASS SPECTROMETER	4	08/07/02

Softwares
OPUSQUAN-GC/MS

APPENDIX C-4

CORRECTIVE ACTION FORM

CORRECTIVE ACTION FORM

Date: _____

Job Name: _____

Initiator's Name and Title: _____

Problem Description: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Reported To: _____

Corrective Action: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Reviewed and Implemented By: _____

cc: Project Manager: _____

Quality Assurance Officer: _____